



Fire Regimes in Siberian Forests

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Introduction

Current forests in Central Siberia manifest clear signs of long-term fire effects that contributed heavily to the way they look today. There is no forest stand now that has not experienced a fire at least once. The number of forest fires has increased considerably in the last centuries due to global climatic changes.

Fire Regimes

Every forest formation has its specific fire regime. A fire regime is a historically evolved factor that determines conditions of fire occurrence, behaviour, and long-term effects. Forest fire regimes are characterized by:

- forest fire frequency and average fire return interval
- fire season development conditions
- drought frequency and extreme fire season occurrence conditions
- lightning forest fire danger rate
- native forest fire danger rate
- type, structure and stock of forest fuels
- type and behaviour of forest fires inherent to a particular area
- possible ecological consequences of forest fires

Central Siberia is a vast region crossed by several climatic and vegetation zones. This accounts for diverse climatic and site conditions that contribute to annual fire occurrence in different parts of the region. Most fires occur in light-coniferous stands. Surface fires of different intensity prevail (90 percent and more of the total number of forest fires). According to statistics, big fires account for up to 1 percent of the total number of forest fires and up to 90 percent of areas burned. Crown fires account for up to 10 percent of areas affected by big forest fires (Valendik, 1996).

Geography of Fire Regimes

The occurrence of forest fires in Central Siberia depends on location: forest fires may occur in April and in the beginning of May in southern areas (50-55°N), in May and June in latitudes 55-60°N, and in June from the latitude 60°N and up. The peak occurs in July.

High fire activity in summer is due to long dry periods, whose total duration sometimes amounts to 115 in some parts of the region, with average duration of one such period of up to 45 days. These droughts make all vegetation highly flammable, natural fire breaks disappear and fires spread freely.

The occurrence of extreme fire seasons characterized by long dry periods and big forest fires accompanied by mass small fires varies in time and space. Extreme fire season periodicity in Central Siberian forests depends on drought frequency and latitude (Kurbatskii, 1975).

Droughts promoting extreme fire events may cover the entire region or part of it. Usually, they are induced by dry and warm air masses coming from Central Asia, Mongolia and the central part of Eastern Siberia. In terms of drought frequency, especially notable are southern areas where they occur seven times a decade, and the eastern part of the region (56-62°N) with five to six droughts a decade.

Fire frequency and return interval depends on the alternation of dry and wet years, weather dynamics,

the type of forest, location of forest, and human activities. To a large extent it also depends on landscape characteristics. Fire frequency is higher in areas bordering on each other than on isolated sites such as islands surrounded by bogs or mountains. In the Yenisei plain, the average fire return interval in pine forests in non-isolated areas is smaller (average duration of fire return interval being 20-40 years) than in isolated areas (average duration of fire return interval being 80-90 years), where the only source of fire is lightning, and the fire return interval depends on the accumulation of forest fuel to the critical level.

The average fire return interval in Siberia's pine forests depends on latitude and decreases from north to south:

- 45-53 years in the northern taiga subzone
- 20-40 years in the central taiga subzone
- 24-38 years (northern border) and 12-21 years (southern border) in the southern taiga subzone
- 6-10 years in pine forests of the subtaiga subzone
- 8-12 years in forest-steppe pine stands
- 13-27 years in mountain pine forests

The mean fire return interval in Angara pine forests has decreased almost two-fold in the last decades due to human activities. At the same time, the average fire return interval in deciduous and dark-needle stands is 90 years and more.

Lightning – an Important Source of Fire

Lightning forest fires in Central Siberia account for 34 percent of the total number of forest fires and up to 90 percent in northern regions. The areas affected by lightning fires are very big due to late detection and remoteness. The average duration of thunderstorms in Central Siberia increases from north to south (from 9 to 84 hours), including 21 hours in Turukhansk, 43 hours in Yartsevo, 54 hours in Pirovskoye, and 84 hours in Nizhne-Usinskoye. The number of cloud-to-ground lightning strikes increases from south to north.

Factors determining the occurrence and consequences of lightning fires:

- latitude
- average duration of thunderstorms
- number of days with thunderstorms
- coincidence of fire period with thunderstorm activity period
- territorial homogeneity
- share of wooded areas
- average class of native fire hazard

Conclusions

The climatic sensitivity of fire regimes changed approximately at the end of the 19th century. Prior to that, fires occurred more simultaneously and were connected with the periodicity of dry periods. Later human activity grew to become a stronger factor controlling fire regimes as compared with climate due to the construction of the Trans-Siberian Railway and the subsequent development of settlements in remote areas.

It has been determined that previous fire regimes were characterized by intensive crown forest fires against the background of mass ground fires. The frequency of surface fires largely depended on weather conditions and landscape. High-intensity fires resulted in forming of uneven-age forest stands.

References

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