Forest fire risk related to the railway transport and evaluation of the effectiveness of firebreaks

Ryszard Szczygieł, Mirosław Kwiatkowski, Bartłomiej Kołakowski, Józef Piwnicki

Forest Research Institute. Sękocin Stary, 3, Braci Leśnej Street, 05-090 Raszyn, Poland. r.szczygiel@ibles.waw.pl, m.kwiatkowski@ibles.waw.pl, b.kolakowski@ibles.waw.pl, j.piwnicki@ibles.waw.pl

Abstract
The study contains an evaluation of the occurrence of forest fires caused by rail transport and the effectiveness of the firebreaks beside railway lines. Analysis was conducted on the basis of information given in a questionnaire completed by forest administration units, inspection of the actual condition of equipment and maintenance of firebreaks and data are obtained from Polish State Railways and the State Fire Service. Analysis showed that approximately 65% of firebreaks are located in forests most subject to forest fires, 90% of firebreaks are made in pine stands, mainly of over 30 years of age (81.8%). Most forest fires occur in coniferous forest habitats (58.3%). Over 60% of all fires occurred in pine stands. Most frequently stands aged from 30 to 60 years (28%). From analysis of the effectiveness of the application of firebreaks beside railway lines it is shown that the first furrow of the firebreak was crossed by 27.3% of all fires. The conduct of extinguishing operations in the case of forest fires adjacent to railway lines is significantly hindered primarily by the late discovery of the fire, difficult access and initiation of burning along a significant length. The conducted investigations indicated the necessity of making and maintaining firebreaks in order to reduce the risk of fire to adjacent forest areas, which appropriately maintained are capable of reducing the risk of fire. The accuracy of this statement is also confirmed by the fact that such a method of protection is applied in many European countries. On the basis of the analysis conducted, a modification proposal has been drawn up for the existing firebreaks also with guidelines, concerning forest fire prevention in forest areas.

Keywords: Firebreaks, forest fire risk, railway transport

1. Introduction
Rail transport, despite technical progress, still constitutes a significant fire risk to forest areas. It is true that over the last 30 years\(^1\) a trend of reduction of the number of fires beside railway lines has been observed (in the years 1981–1990 rail transport was the cause of 5.92% fires, in the years 1991–2000 – 2.1%, and in the years 2001–2010 – 0.81% of all fires recorded), the greatest forest fire disasters occurred beside railway lines (Forest District: Rudy Raciborskie – 9060 ha and Potrzebowice – 5130 ha). Among the established causes of fires, those, which occurred because of rail transport, are seventh out of nine in statistical classification. The frequently compared cause - road transport - in the years 2001-2010 constituted the cause of 0.34% of forest fires, which is under half of the number of fires caused by rail transport.

According to the analysis of the Railway Scientific-Technical Centre\(^2\) over 90% of forest fires were caused by sparks from brake blocks, or as a result of their friction. In such a situation, where fire embers are caused, the role of passive fire protection is filled by the firebreak, executed alongside the railway line, the role of which is to prevent or limit the possibility of the spread of fire to the adjacent

\(^1\) Statistical data of the Forest Research Institute