Chapter 15
The Influence of Fires on Forest Ecosystems

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ABSTRACT

The chapter focuses on the role of fire as an environmental factor affecting the components of the forest ecosystem. The classification of forest fires according to the fire location in the forest ecosystem is given. Negative impact of fire on communities and people, components of forest ecosystems: a phytocoenosis (the forest under-growth, understory, ground cover), tocinos (animal world), klimatop (atmosphere and climate) and adatom (topography and soil) are discussed. The role of fire as a factor of organisms and natural ecosystems’ evolution in general is studied. The problems of forest restoration on fires (fumes) are considered. Research established that the degree of damage to the ecosystem components and social consequences depend on the forest fire type, natural conditions, and forest conditions of the region.

INTRODUCTION

At the earth Summit in Rio de Janeiro in 1992, the UN Convention on climate change was solemnly adopted. It entered into force on 21 March 1994 and was signed by representatives of more than 180 countries. The Convention specifies the need for cooperation in the development and dissemination of technologies, methods and processes that reduce anthropogenic emissions of greenhouse gases, in particular forestry, as well as the rational use of sinks and reservoirs of all greenhouse gases, including forests (United Nations framework, 1992). In the development of modern public policies, most States,
along with the effects of climate change, attach great importance to the conservation and sustainable use of living natural capital based on biodiversity conservation (Johannesburg Declaration, 2002). The global environmental role of forests is also reflected in the UN Convention On biological diversity (The UN Convention, 2002), the statement of principles for a global consensus on the management, conservation and development of all types of forests (Management, 1992), and the national sustainable development strategies of many countries.

The international community recognizes that forests are essential for biodiversity conservation, carbon sequestration and oxygen release. They are the valuable source of renewable energy. One resource of nature use is replaced by an integrated management, taking into account characteristics of the ecosystem.

The forest is considered to be not only as a source of wood, but also as a habitat of various species and some carrier of the most important functions, including soil protection from erosion processes, an active participant of water and gas exchange, recreation area, part of the landscape and natural heritage, “business card” of a territory (Perelet, 2006; Pasko, 2013). The ecosystem approach involves the analysis of the forest as a community of living organisms that interact systematically with each other and with non-living components of the habitat. Biotic and abiotic components are linked together through nutrient cycles and energy flows (Ecosystems and People, 2019) and their disruption to one component leads to changes in the structure and relationships of the entire ecosystem.

Up to 400,000 forest fires occur on earth each year, the area of burning reaches 0.5% of the total forest area and about 1-4 billion tons of coal are released into the atmosphere each year by forest fires around the world (Andreae & Goldammer, 1992).

Extreme and catastrophic forest fires are known. In 1871 the fire “of Peshtigo” has been. It’s area of about 1.5 million hectares resulted to the deaths of 1,150 people in Wisconsin and Michigan (USA). In 1915, Siberian forest fires covered an area of 12 million hectares and led to the formation of thick smog, which lasted about 50 days. In 1972 forests and peat bogs were burning in the European territory of Russia in the area of over 100 thousand square kilometers during the summer months. 104 people were killed by their fire only in the Moscow region.

The main causes of forest fires are: human activity, lightning, spontaneous combustion of peat edges and agricultural fires in hot weather. Forest fires destroy trees, undergrowth, underwood, ground cover and harvested wood (Fig. 2) (Pasko @, Baranova, 2014). They also reduce the value of forest land significantly. Water protection, protectiveness and wood together with other useful forest properties are decreasing as a result of fires. The fauna perishes, engineering constructions, and in some cases – the whole settlements are destroyed. The landscape of the district changes (Fig. 3) the atmospheric pollution by combustion products.

A number of scientists regard forest fires as an integral factor of evolution that forms the biodiversity of natural habitats along with the statement of negative economic, environmental and social consequences. They note that organisms in ecosystems have adapted to forest fires and even use them in their life cycles. Fire is regarded as a natural phenomenon similar to flooding, volcanic eruptions, etc., which is an instrument of natural selection of species and contributes to the survival of the fittest individuals.

The new scientific direction “Fire ecology” is actively developing nowadays. The objects of its research are often prairies, savannas, coniferous forests, etc. They are formed with the participation of fire as an essential evolutionary factor that determines the viability of the ecosystem and the renewal of the habitat of living organisms. The subject of the study of fire ecology are natural processes due to the presence of fires in the ecosystem, such as; the interaction of fire, abiotic and biotic components of the ecosystem; ecosystem approach to the evolution of organisms and so on.
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