Results of monitoring of carabid communities in forests damaged by the wind storm in High Tatra Mts. in 2004

Zbyšek Šustek

Institute of Zoology, Slovak Academy of Sciences, Dúbravská cesta 9, 845 06 Bratislava, Slovakia, e-mail: zbysek.sustek@savba.sk

Abstract. The Carabid Communities in the spruce forests in High Tatra Mts. damaged in November 2004 by the storm exhibited simultaneously two main trends. The first trend includes the sharp differentiation of the communities according to the actual state of the damaged sites into three groups:

(1) the site with the timber remaining *in situ* shows only quantitative and easily reversible changes in rapport to the intact stand, there have been preserved all characteristic stenotopic forest species, while there have not been recorded any xenocoenous species invading from open landscape.

(2) the sites with extracted timber, where less tolerant forest species disappeared (*Carabus linnei, Pterosctichus unctulatus, Pterostichus burmeisteri*), while more tolerant forest species (*Carabus violaceus, Carabus glabratus*) were favored by the occurred changes and some non-forest mountain of species appeared here (e. g. *Amara erratica*).

(3) the sites with extracted timber and additionally damaged by the fire in July/August 2005, where number of the stenotopic forest species and their abundance were strongly reduced, the more tolerant forest species survived, but there occurred temporal invasions of xenocoenous species (*Pterostichus cupreus, Pterostichus versicolor, Bembidion lampros. Pseudoophonus rufipes, Microlestes maurus, Amara nitida*) from the fields in the lower parts of the Popradská kotlina basin.

This differentiation can be explained by autecology of individual species, the state of habitats and undertaken forest management measures, especially the cutting of the *Chamerion angustifolium* in the artificially afforested parts of the burned area (presence of heliophilous *Bembidion lampros* and *Microlestes maurus* in cut places*)*. However, by the end of the studied period, the communities in both, the burned and unburned sites converged due to partial restoration of vegetation cover in the burned sites, but they continued to strongly differ from the site with timber *in situ*.

The second trend includes a striking decline of number of species and individuals and cumulative biomass in all sites in 2008 and a gradual increase in these parameters in the next years. This trend was very similar in all sites and can be explained as a retarded and long lasting consequence of the extremely dry winter 2006/2007 and growing season of 2007 and a series of more humid years 2008 - 2011. The Standardized Precipitation Index (SPI) and the Standardized Evapotranspiration Index (SPEI) calculated for 24 months fitted best these changes. The results show that the next succession will depend not only on the restoration of vegetation, but will be essentially influenced by climatic changes. There appears a question of consequences of the dry and warm growing season 2012.

In addition to these two trends, a spreading of some forest Carabids having occurrence optimum in lowlands (*Carabus coriaceus, Carabus hortensis,* and *Carabus nemoralis*) was observed in the site Vodný les at the western margin of Nový Smokovec since 2009. This spreading has a progressive tendency and might be interpreted, with reserve, as a consequence of warming of the climate. But it can also be just a consequence of shifts in occurrence foci of individual species. Its real causes will be clearer only in future.

The results of monitoring of Carabids support, as a partial point of view, the opinion that keeping the timber *in situ* was the best mode of management of the damaged ecosystems in a protected zone. Of course, there also exist other silvicultural, economic and social aspects of this problem.