ACTA SCIENTIARUM POLONORUM
Acta Sci. Pol.
Silv. Colendar. Rat. Ind. Lignar. 11(1) 2012, 43-47

SMALL SCALE CONSERVATION STATUS IN FORESTS – SOURCE OF BARK BEETLE PROBLEMS?

Paulius Zolubas[1], Remigijus Dagilius[2]
[1]Lithuanian University of Agriculture
[2]State Forest Survey Service

Abstract. Using GIS techniques, spruce bark beetle *Ips typographus* (L.) damage was analysed against distance from the edge of small spruce stands with strict protection regime; for reference damage nearby managed spruce stands was used. Mean volume of spruce timber, harvested with sanitary fellings was significantly higher near spruce stands with strict conservation status (14.7 ±2.1 to 17.0 ±3.8 m^3/ha) than in the vicinity of managed control sites (9.9 ±0.4 to 11.5 ±0.8 m^3/ha). Under endemic spruce bark beetle population levels strict conservation regime in small areas (forest woodland key habitats of average 3.7 ha size) was found to be *Ips typographus* hazard for adjacent spruce forests up to 450 m distance.

Key words: spruce bark beetle, *Ips typographus*, hazard, selective sanitary felling, woodland key habitat, managed forest

INTRODUCTION

It is clearly recognised that maintenance and enhancement of biological diversity is a key element of ecological sustainability in the forests. One of the instruments for conservation within forest sector in Lithuania is total management prohibition in woodland key habitats (WKH). Woodland key habitat is defined as an intact forest area with a high probability of the presence and non-accidental occurrence of an endangered, vulnerable, rare or care-demanding habitat specialist species. The WKH concept was developed in Sweden during the early 1990s and later transferred to Nordic and Baltic states. Introduction of woodland key habitats in Lithuania was implemented by a two--stage inventory project – pilot stage 2001-2002 and full-scale inventory in 2002-2005. Ban on all management options (strict conservative regime) was more or less imposed on all inventorised and future WKH.

Spruce bark beetle *Ips typographus* (L.) is the most important pest in premature and mature stands of Norway spruce (*Picea abies* Karst.) in Lithuania and in a prevailing

Corresponding author – Adres do korespondencji: Paulius Zolubas, Studentų 11, Akademija, LT--53361 Kaunas, Lithuania, e-mail: zolubasp@gmail.com; Remigijus Dagilius, State Forest Survey Service, Pramonės 11a, LT-51327 Kaunas, Lithuania, e-mail: remis@lvmi.lt

part of Europe. Damage of spruce bark beetle is being recorded on an average on a few thousand hectares of spruce stands in Lithuania every year. Bark beetles under normal (endemic) population levels reproduce themselves in single stressed or wind-felled spruce trees. To minimize risk of subsequent attacks on living trees, removing infested trees out of the forest should be done as early as possible.

Strict conservative status of woodland key habitats in spruce stands should be bark beetle hazard, firstly because woodland key habitats are small – the average size of a WKH is 3.21 ha and the median size is 1.74 ha – and would not host increased bark beetle population; buffer zone, usually one tree height size is set to protect microclimate in the site [Anderson and Kriukelis 2002], and will not shield surrounding stands from spreading bark beetles. Secondly, 1339 (21% of all forest WKH) woodland key habitats in Lithuania were set apart in old spruce stands, which are especially sensitive to *Ips typographus* [Anderson and Kriukelis 2002]. Thirdly, small woodland key habitats are randomly scattered throughout entire Lithuania, and in the case of bark beetle population burst, multispot pest gradations will occur and expand in wide areas immediately.

To quantitatively support or deny these hazard assumptions, research on bark beetle damage around woodland key habitats in spruce stands (small scale areas with strict protection regime) was accomplished.

MATERIAL AND METHODS

Bark beetle damage was quantified as volume of spruce timber (m^3/ha), harvested with selective sanitary fellings in forests, susceptible to spruce bark beetle (≥ 60% spruce in tree species composition, over 60 years old) in four randomly selected forest enterprises in 2003. Using GIS techniques, volume harvested was analized against distance from the edge of woodland key habitats (A1 – spruce and mixed spruce forests and C2 – spruce and mixed spruce wetland forests). The analysis was performed to the distance of 500 m in 50 m intervals. When stand covered more than one 50 "slice", the volume harvested was divided proportionally to the area in each interval. For reference, volume harvested with selective sanitary fellings was analysed from the edge of randomly chosen spruce stands with no management restrictions, located at least 1 km apart WKH and each other.

Standard statistical procedures were applied to the data, significance of difference were estimated using Student-t statistic [Campbell 1989].

RESULTS

Total 118 woodland key habitats and 7906 managed spruce stands in 4 forest enterprises were analysed. Mean volume of spruce timber, harvested with selective sanitary fellings varied from 9.9 ±0.4 to 11.5 ±0.8 m^3/ha surrounding managed (control) sites and from 14.7 ±2.1 to 17.0 ±3.8 m^3/ha around spruce woodland key habitats, unmanaged sites with strict conservation status (Fig. 1).

Increased spruce bark beetle damage was constantly higher up to the distance of 450 m from the stand edge, no trend regarding distance have been recorded. 500 m apart from the edge of spruce stand, potential bark beetle source, difference of damage level was not significant.

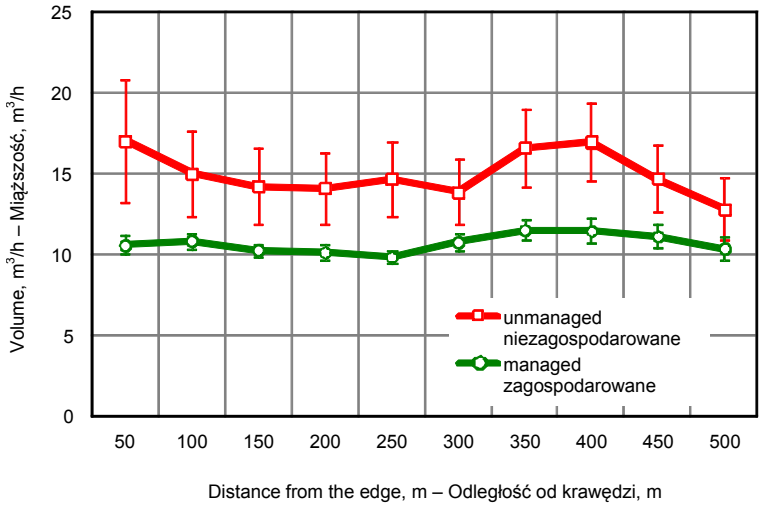

Fig. 1. Mean volume of spruce selective sanitary fellings near the spruce stands with conservation status and without it (vertical bars represent mean error)

Rys. 1. Średnia miąższość drewna świerkowego pozyskanego w cięcich sanitarnych w pobliżu drzewostanów o statusie ochronnym oraz w innych miejscach (pionowe odcinki linii przedstawiają błąd średniej)

DISCUSSION

Results confirm that small unmanaged areas can be considered as reservoirs of spruce bark beetle. The increased volume of selective sanitary cuttings around unmanaged spruce stands demonstrate that spruce bark beetle *Ips typographus* could spread from these small conservation areas into surrounding forests at least up to 450 m. The observation differs from the rezults of another research, where bark beetle numbers in pheromone trap catches were similar inside two reserves (unmanaged) and in managed areas; however, even authors themselves outline doubtful reliability of data, and two probable causes for overestimated pest population (similar or somewhat larger catches outside the reserves, respectively) refer to trapping technology issues [Schlyter and Lundgren 1993]. Similarly, Weslien and Schroeder [1999] have found that the number of *I. typographus* caught in spruce bolts and window traps was almost identical for the managed versus unmanaged stands; however, research was made on much bigger scale, pairs of compared stands being few kilometers apart [1999], therefore results may not fit small scale sites.

Key factors promoting a bark beetle outbreak ("epidemic" level) are: the abundance of suitable breeding material, a high initial beetle population, and climatic conditions afterwards [Abgrall 2001, Forster 1993]. Generally spruce bark beetle population build up on the abundance of suitable breeding material, which often is provided by calamities, such as wind. There were no extreme winds during 2000-2003 in our study area; therefore pest population augmentation around small unmanaged spruce stands should

be attributed to conservation status. Hazard in managed sites is increased by lower regulatory press of natural enemies – two- to three-fold lower numbers of four insect species, known to be common predators in *I. typographus* galleries, were caught in managed stands rather than in unmanaged ones [Weslien and Schroeder 1999].

In Lithuania, woodland key habitat inventory project objectives were to develop definitions, inventory methodology and classification system first. Nevertheless, excited environmentalists already in pilot stage achieved prohibition (albeit semi-legal) of all activities in future woodland key habitats, including pest and disease management; no forest pest/disease or any other risk analysis have been made so far. Selective sanitary fellings in spruce stands are used to remove green windthrown and bark beetle freshly infested trees from the forest (forest hygiene), and this is the must, implicated in Forest Sanitary Protection Rules – law, obligatory to all forest owners and managers in Lithuania [Forest... 2001]. Therefore reckless amateur efforts with noble intention of biological diversity conservation in small mature spruce stands not only conflict with law enforcement, but also create constant resource of *Ips typographus* and threaten the surrounding forests.

Although it is believed that forests with rare and threatened biodiversity at woodland key habitat level are rare and make up only a small percentage of the state forests of Lithuania [Anderson and Kriukelis 2002], their conservation value may be outweighted by negative impact in the case of bark beetles and spruce stands.

REFERENCES

Abgrall J.F., 2001. La tornade de decembre 1999: risques phytosanitaires et strategies de gestion. GIP Ecofor, Paris.

Andersson L., Kriukelis R., 2002. Pilot woodland key habitat inventory in Lithuania. Vilnius.

Campbell R.C., 1989. Statistics for biologist. Cambridge Univ. Press Cambridge.

Forest sanitary protection rules. 2001. State News 56 (2003), 74-80 [in Lithuanian].

Forster B., 1993. Entwicklung der Borkenkafersituation in den Schweizer Sturmschadengebieten. Schweiz. Z. Forstwes. 144, 767-776.

Schlyter F., Lundgren U., 1993. Distribution of a bark beetle and its predators within and outside old growth forest reserves, and factors affecting its occurrence. Scand. J. For. Res. 8, 246-256.

Weslien J., Schroeder L.M., 1999. Population levels of bark beetles and associated insects in managed and unmanaged spruce stands. For. Ecol. Manag. 115 (2-3), 267-275.

STATUS OCHRONNY LASÓW NA MAŁYCH POWIERZCHNIACH – ŹRÓDŁO PROBLEMÓW Z KORNIKAMI?

Streszczenie. Wykorzystując technikę GIS, analizowano drzewostany świerkowe uszkodzone przez kornika *Ips typographus* (L.) w różnych odległościach od małych drzewostanów świerkowych objętych ochroną ścisłą; dla porównania wykorzystano uszkodzenia występujące w pobliżu gospodarczych drzewostanów świerkowych. Średnia miąższość drewna świerkowego pozyskanego w cięciach sanitarnych była istotnie większa w pobliżu drzewostanów świerkowych o statusie ochrony ścisłej (od 14,7 ±2,1 do 17,0 ±3,8 m^3/ha) niż w pobliżu drzewostanów gospodarczych (od 9,9 ±0,4 do 11,5 ±0,8 m^3/ha). Stwierdzo-

no, że w warunkach występowania endemicznej populacji kornika drukarza na małych powierzchniach ochrony ścisłej (kluczowe siedliska leśne o średniej powierzchni 3,7 ha) zagrożenie sąsiednich drzewostanów świerkowych przez *Ips typographus* występuje do odległości 450 m.

Słowa kluczowe: kornik drukarz, *Ips typographus*, zagrożenie, selektywne cięcia sanitarne, leśne siedliska kluczowe, lasy gospodarcze

Accepted for print – Zaakceptowano do druku: 4.06.2012

For citation – Do cytowania: Zolubas P., Dagilius R., 2012. Small scale conservation status in forests – source of bark beetle problems? Acta Sci. Pol., Silv. Colendar. Rat. Ind. Lignar. 11(1), 43-47.