

The Storm "Gudrun" and the Spruce Bark Beetle in Sweden

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Abstract

Monitoring of the spruce bark beetle involving pheromone trap catches and beetle-killed trees has been performed since 1995. After the storm fellings of 2005 and 2007 the monitoring was expanded from four to 34 areas (10000-40000 ha). Trap catches increased substantial in the region affected by the storm compared to moderate catch levels outside this region. High catch levels in most areas did not correspond to an expected high level of damage. The number of killed trees decreased from 14/km in 2006 to 7/km in 2007. The impact of weather and remaining wind-felled spruces in the forest on trap catches and damage level is discussed.

Keywords: Monitoring, *Ips typographus*, pheromone trap, spruce bark beetle, storm-felling

Kurzfassung

Der Sturm "Gudrun" und Fichtenborkenkäfer in Schweden

Über die Entwicklung des Buchdruckers geben Pheromonfallen-Fänge sowie die Zahl an Borkenkäferfichten Auskunft. Dieses Monitoring wird seit 1995 in vier verschiedenen Gebieten durchgeführt. Nach den Sturmschäden in den Jahren 2005 und 2007 wurde das Monitoringprogramm von vier auf 34 Gebiete (10000-40000 ha) erweitert. Die Fangzahlen der Pheromonfallen im Windwurfgebiet stiegen beträchtlich. Außerhalb waren sie nicht erhöht. Die hohen Fangzahlen fast aller Gebiete korrelierten nicht mit dem erwarteten hohen Schadensausmaß. 2006 wurden 14 Fichten je Kilometer Bestandesrand vom Buchdrucker befallen, 2007 verringerte sich diese Kennziffer auf sieben pro Kilometer. Der Einfluss von Wetter und im Wald belassenem Windwurfholz auf Fangzahlen sowie das Schadensausmaß werden diskutiert.

Schlüsselworte: Überwachung, *Ips typographus*, Pheromonfalle, Buchdrucker, Windwurf

In January 2005 about 75 million m³ of trees, mainly Norway spruce, were felled by wind in southern Sweden (Figure 1). In addition, 12 million m³ were felled by the storm "Per" in early 2007 in approximately the same area (Figure 2). Salvage logging has been intense but several tenths of million m³ of spruce remained in the forest during the first summer. Also in the second summer millions of m³ were still lying in the forest. Large quantities of timber have been stored and are still stored and sprinkled with water (Figure 3). Many downed trees

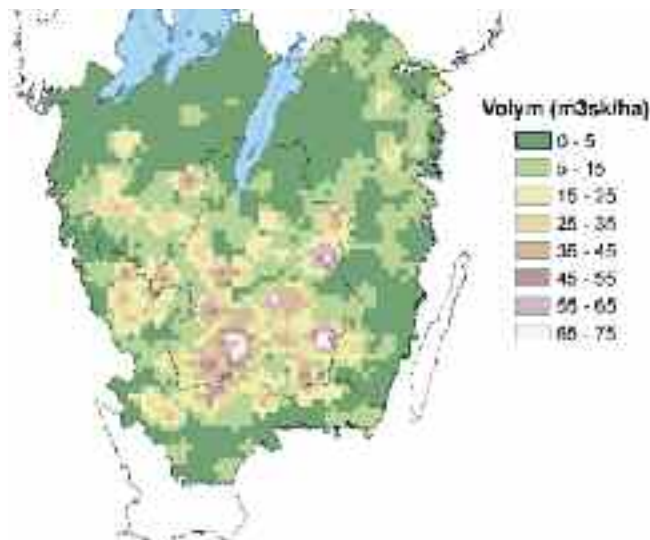


Figure 1: Areas damaged by "Gudrun" in January 2005

Abbildung 1: Durch "Gudrun" im Jänner 2005 geschädigte Flächen

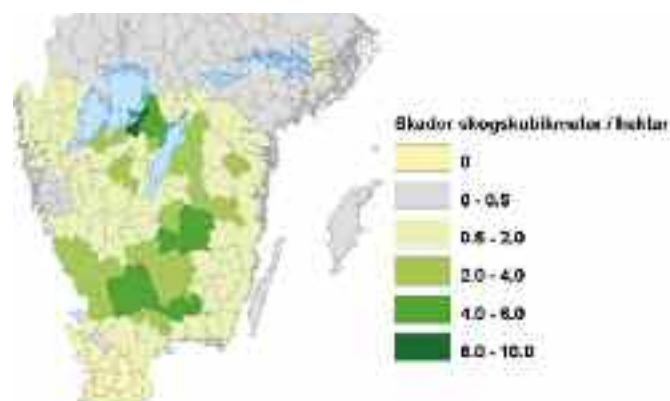


Figure 2: Number of m³/ha felled by "Per" in January 2007

Abbildung 2: Windwürfe durch "Per" im Jänner 2007 in fm/ha



Figure 3: Byholma 31 May 2007: 1 million m³ of timber, sprinkled with water

Abbildung 3: Byholma am 31. Mai 2007: 1 Million Festmeter nassgelagertes Holz

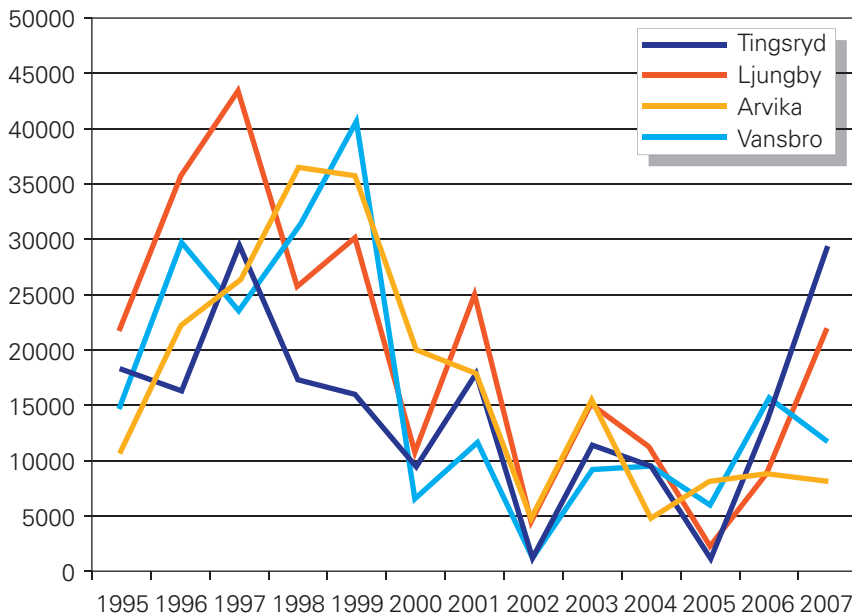


Figure 4: Pheromone trap catches 1995-2007: Numbers refers to total catch May-August in three traps (Nove).

Abbildung 4: Pheromonfallenfänge 1995 bis 2007: Gesamtfangzahlen von Mai bis August aus drei Fallen (Nove)

from the storm “Per” remained in the forest during summer. The volume of trees available for the spruce bark beetle is not known, but a substantial number acted as trap trees since they were cut and transported out of the forest during and after beetle flight in summer 2007 (Schroeder, unpublished).

The population level was relatively low in 2004 according to monitoring data (Figure 4). Only a minor part, around three to five percent of the huge number of wind-felled spruce trees were subsequently colonised by

the spruce bark beetle in the first summer 2005 (Schroeder, unpublished; Wulff & Hannson 2007). Thus, there was an obvious excess of breeding material in the first season. No standing trees were killed in 2005. In 2006, approximately 50 % of the remaining wind-fallen trees were colonised by the spruce bark beetle (Schroeder, unpublished; Wulff & Hannson 2007). In both years a high production of spruce bark beetles was observed in the fallen spruce trees. The reproduction rate (\bar{Q}/\bar{q}) in the first generation was about ten in both years (Schroeder, unpublished).

In the second half of summer 2006, unusual high temperatures and drought favoured spruce bark beetle attack, partly establishing a second generation. At the same time, drought increased the stress in trees, already having roots damaged by wind and thus making the trees more vulnerable to beetle colonisation. Numerous standing trees were attacked and killed in late summer 2006. The late attacks are probably made by parent beetles performing sister flights and a proportion of the new generation of beetles, generally reproducing after hibernation. The development of the second generation was completed in the mild autumn. It has been estimated that about 1.5 million m³ of standing spruce trees was

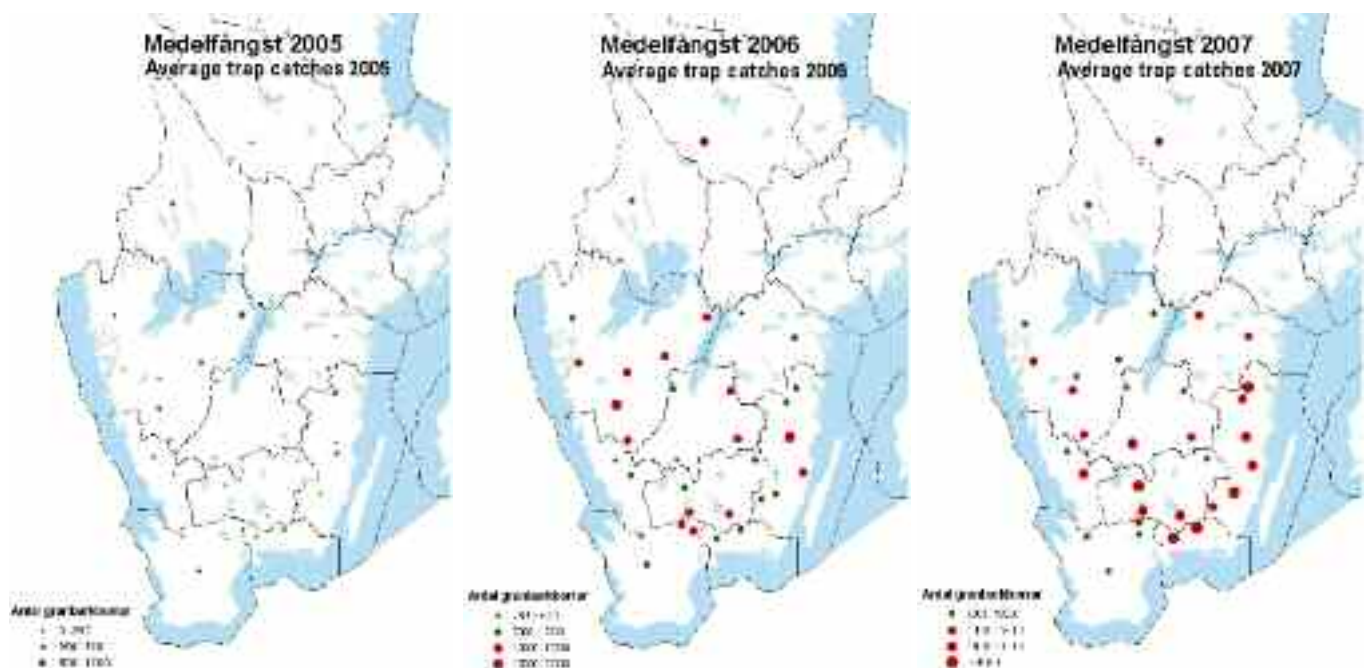


Figure 5: Pheromone trap catches May-August: Numbers refers to catches in three traps.

Abbildung 5: Pheromonfallenfänge von Mai bis August: Fangzahlen von drei Fallen

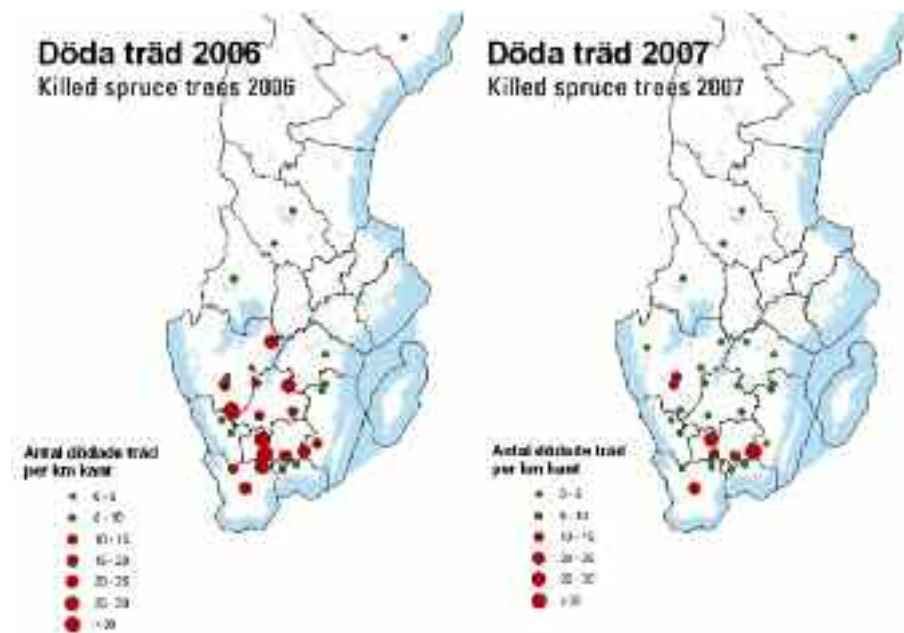


Figure 6: Number of spruce trees killed by the spruce bark beetle in stand edges (per km)
Abbildung 6: Anzahl von Borkenkäferbäumen an Bestandesrändern (pro km)

killed in 2006 (Forestry agency). This is probably an underestimation since many trees were still green and not visible until winter and thus not included in the estimation. The reproduction rate in the standing trees was about 5 (Schroeder, unpublished) which is quite high for standing trees. The low egg gallery density indicates a low resistance in the trees.

In 2007, the volume of killed spruce trees decreased and amounted to 0.5-0.8 million m³ (Swedish National Forest Inventory, Wulff and Hansson 2007, and estimation made by Forest agency). In the second part of the summer, rain suppressed flight activity and improved conditions for the trees. There were many signs of higher resistance to bark beetles attempting to colonise the trees, e.g. resin flow and unsuccessful colonisation of trees. A substantial “trap tree effect” after the storm “Per”, by trees colonised by beetles otherwise killing standing trees, can not be excluded (Schroeder, unpublished).

In a specific monitoring of the spruce bark beetle using pheromone traps and surveying killed trees in stand edges has been performed in four regions in Sweden since 1995. The system involves three traps on five clear-cuts in each region (10000-40000 ha). In 2005, after the storm, the monitoring was expanded to 34 regions.

In 2007, a detailed registration of the flight activity using weekly pheromone trap catches was performed in six regions and the data was published on the homepage of the Forest Agency.

In Figures 5 and 6, trap catches and numbers of killed spruce trees at stand edges during 2005-2007 are presented. Trap catches indicate an increasing population in 2006 and further in 2007 compared to areas outside the storm area. The number of killed trees increased dramatically in 2006 compared to 2005 and

than decreased from on average 14/km stand edges in 2006 to 7/km in 2007. The decrease of standing trees being killed may be explained by a combination of an increased resistance in standing trees during late summer as well as a “trap tree”-effect caused by remaining wind-felled trees being colonised.

Control

In 2005 salvage logging of wind-felled trees was intense and involved a lot of storage of timber sprinkled with water. Only small volumes were allowed to be stored in lakes. In 2006, besides salvage logging, sanitation logging of killed trees was done during the whole year. Sanitation logging was not

recommended in the end of 2007, since it was discovered that most of the bark fell off and only a minor part of the beetles were removed from the forest using this method (Schroeder, unpublished). Instead, sanitation logging during summer has been strongly recommended. Plastic pheromone traps (25000) and insecticide treated trap logs (20000) were used in 2007, although the effect on the damage level is unclear. In the area of control, defined by the Forestry Agency a maximum of 3 m³ of fresh spruce may be left after the storm-fellings. Cut trees and logs must be transported out of the forest before the 1st of July.

According to an estimate by the Forest Agency, about 1 to 3 million m³ could be killed by the spruce bark beetle in 2008. Beetles produced in wind-felled trees during summer 2007 as well as beetles produced in standing trees or in the bark in trees still left in the forest are still remaining in the duff. New trees on the ground after storm fellings this winter may act as trap trees, but the time during summer when these trees should be cut and brought out of the forest is limited. Instead, forest owners are strongly recommended to do salvage logging as soon as possible.

References

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