

# Storm-damaged forests mapped by military radar technology

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In January 2005, FOI (Swedish Defense Research Agency) and Ericsson Microwave Systems mapped storm-damaged areas in southern Sweden using military airborne radar technology mounted in a test aircraft operated by FMV (Swedish Defense Materiel Agency). The trial shows that the technology can cover large land areas as well as identify individual trees including those damaged by winds.

"The results are very promising," says Lars Ulander at FOI. "This technology enables us to get an overview and detailed information which neither aerial photography nor satellite images can provide. This is needed in order to find small and dispersed wind-felled areas, that is, where only a minor portion of the trees have been affected. What's more, you get good radar images also under poor weather conditions."

The CARABAS-II synthetic aperture radar was used to map two areas in southern Sweden: Växjö-Ljungby in Småland and Tönnersjöheden in Halland which were both severely damaged by a hurricane on 8 January 2005.

"Our radar pictures show that we can clearly distinguish wind-fallen trees from those which are still standing," says Lars Ulander at FOI. "That is usually the hardest part when you take aerial pictures of storm-damaged areas. The National Board of Forestry estimates that the damage amounts to about 70 million cubic meters of timber volume, but they are aware that this is a low estimate since it is difficult to assess the damage in areas where only a small part of the trees have fallen down.

Besides mapping the storm-damaged forests, CARABAS images make it possible to estimate the timber volume of the still standing forest, which is necessary information for setting up new forestry plans.

Intensive work is underway in southern Swedish forests to salvage the timber in damaged areas. However, everyone knows already that there will be a lot of damaged timber remaining in the woods when summer comes, and the risk of large-scale insect infestations is great. Huge economic assets are at stake and the standing forests must be protected from insects.

"Another, more detailed, mapping will be needed in early summer to get an detailed estimate of how much timber is left in the forests, especially in stands that suffered only limited loss of trees. The National Board of Forestry is truly eager to see whether CARABAS technology can serve as a complement to regular aerial photography and satellite images in mapping small damaged areas," says Magnus Fridh, Head of the Analysis Unit at the National Board of Forestry. A strategic mapping has already been performed based on visual observations from low-flying airplanes.

"The mapping needed in early summer, however, will require considerably more detail in order to find the areas with limited damage," says Lars Ulander at FOI. It is relatively simple to identify areas where all of the trees are down. You can see that both from aerial photos and from satellite images. The problem is that the spruce trees in Småland stand so close together that it is difficult to interpret aerial photos and satellite images. This may be a break-through for the CARABAS technology.

The production of maps and verification of the CARABAS images is being carried out in collaboration with Dianthus, the Swedish University of Agricultural Sciences in Umeå, and Chalmers Institute of Technology.

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