

# ShortCuts

FROM SKOGFORSK. NO 1 | 2016 | RESEARCH FOR TOMORROW'S FORESTRY



SMART TREE RETENTION:  
DEAD WOOD  
PROMOTES  
NEW LIFE

## MONITORING *“Fantastic!”* TOOL FOR THINNING

---

WIND-DEFLECTING TRUCKS...AND BIGGER TRUCKS | INTELLIGENT BOOM CONTROL

HEAD-UP DISPLAY | EFFICIENT ROAD MAINTENANCE WITH OPTIMISATION

---

CONTINUOUS COVER FORESTRY MORE EXPENSIVE

---

NEW DOCTORS | TARGET DESCRIPTIONS FOR CONSERVATION

---



Claes Löfroth tests the wind tunnel.

PHOTO: SVERKER JOHANSSON, BITZER

# WIND-DEFLECTING TRUCKS

Fuel consumption of timber trucks can be reduced by up to ten percent with a better aerodynamic shape. This is shown in a Skogforsk study, where timber trucks were tested in a wind tunnel.

■ Timber trucks comprise a significant proportion of the HGV fleet on Swedish roads. Even a small reduction in diesel consumption would significantly reduce total emissions and improve transport economy. This is the first time that timber trucks have been tested in a wind tunnel.

“Wind deflection plays a very big role in our Nordic climate,” explains Claes Löfroth at Skogforsk. “For example, Canadian studies have shown that air resistance increases by around 20 percent in winter conditions,

and this in turn increases fuel consumption by around ten percent.

“In the pilot study, we’ve discovered air turbulence, particularly between the truck and the trailer, and behind the vehicle,” continues Claes Löfroth. “This turbulence retards the vehicle, and that’s where we believe the great potential lies. We’ve tested many types of shield to reduce the air resistance in these parts.”

CONTACT:  
Claes Löfroth, Skogforsk | 018-1885 07  
claes.lofroth@skogforsk.se



PHOTO: ERIK WIKLUND, SKOGFORSK

## BIGGER TRUCKS CAN SAVE 44,000 TONNES OF CARBON DIOXIDE

Bigger trucks could drastically reduce the environmental impact of forestry transports. This is shown in new studies of trucks with a gross weight of 68-90 tonnes.

■ “If the forestry sector could transport all the timber with these bigger trucks, in just one year 16.8 million litres of fuel and 44,200 tonnes of carbon dioxide emissions could be saved,” says Fredrik Johansson, who led the study.

In 2014, Skogforsk carried out an in-depth study of 14 large-truck transports. The studies showed that the higher payload reduced fuel consumption

by 106,000 litres and carbon dioxide emissions by 307,000 kg. If these results were scaled up to all Swedish forestry transports, using these larger trucks with gross weights of 68, 74 or 90 tonnes would have very positive environmental effects.

“The 90-tonne trucks are the most efficient,” says Fredrik Johansson. “Longer vehicles with more timber stacks are needed if we are to fully utilise potential payloads, particularly in the summer when the wood is dry and light.”

CONTACT:  
Fredrik Johansson, Skogforsk. 018-1885 35  
fredrik.johansson@skogforsk.se

### JOBBA I SKOGEN MOVES TO KUNSKAPSBANKEN

The website Jobba i skogen (‘Work in the Forest’) has moved to skogforsk.se. The content remains the same: practical advice and tips for operators of forest machines, aimed at improving the efficiency of the work and improving the work environment.

‘Work in the Forest’ is aimed at anyone working in the forest. The site contains articles, tips and examples of good practice, calculation tools, films, and checklists. The focus is on felling, forwarding, landings, planning



and work environment.

The site was launched in 2012, and has now moved to Kunskapsbanken at skogforsk.se. Here, the site has its own home page, and is continually updated with new articles.



PHOTO: MARTIN ENGLUND, SKOGFORSK

## BETTER OPERATOR TRAINING WITH INTELLIGENT BOOM CONTROL

Forestry students who use intelligent boom control operate machines more efficiently, adjust controls less often, and experience a lower workload than those who operate forwarder cranes with conventional controls.

■ The results confirm earlier findings from Skogforsk that show that intelligent boom control\* improves efficiency in forwarding, and reduces strain on the operator.

“Because crane operation was easier for students who started with intelligent boom control, we also believe that they had more mental resources left over to understand and learn other

aspects of forwarding,” says Martin Englund, who led the study.

The students then changed places. There were no problems for those who switched to intelligent boom control – it had positive effects instead. But switching from intelligent boom control to conventional controls was more difficult.

\*) Intelligent boom control means that the operator indicates the movement direction of the crane with a joystick instead of controlling every single crane component.

CONTACT:  
Martin Englund, Skogforsk | 018-18 85 79  
martin.englund@skogforsk.se

## HEAD-UP DISPLAY DOES NOT IMPROVE PRODUCTIVITY

– *but useful in decision support*

Monitoring bucking data in the windscreen of the harvester instead of via the conventional bucking computer monitor gave no measurable improvement in productivity – not when experienced operators were involved at any rate.

■ Skogforsk has carried out a study with a head-up display, where the harvester data information is projected directly onto the wind-screen. The operator does not need to look down at the conventional monitor, and can focus entirely on the harvester head.

In an earlier study involving a simulator, the new technology reduced workload and increased productivity, but the result could not be repeated in the field study.

“But the operators were positive to data being projected onto the window of the cab, and that in itself is interesting,” says Martin Englund, who is studying work environment issues at

Skogforsk. “Decision support tools are becoming increasingly common in forest machines, giving more information for the operator to respond to. A head-up display can be a good way to present some of the data.

“This technology should be most beneficial where felling involves many assortments,” adds Martin Englund. “An earlier study has shown an operator often has look down at the bucking computer. It may also be an experience issue.”

CONTACT:  
Martin Englund, Skogforsk | 018-18 85 79  
martin.englund@skogforsk.se



PHOTO: SVERKER JOHANSSON/BITZER

### REDUCE OPERATOR STRESS

The information environment in a harvester is hectic. For each tree, the operator has to make a large number of decisions in a short time, while also considering factors such as the environment and operating route.

Since a poor information environment can lead to mental stress and neck and shoulder pains, and increase the risk of stress-related disorders, Skogforsk has been testing various ways to improve it. A head-up display can be one way forward.

# MORE EFFICIENT ROAD MAINTENANCE WITH OPTIMISATION

Results from case studies involving three forest companies show that an optimisation model can improve efficiency of road investments in forestry.

■ “We think that upgrading costs can be reduced by 15-20 percent,” says Victor Asmoarp at Skogforsk.

The model – called RoadOpt – is based on a logging plan, a plan showing seasonal demand for wood products, information about the road bearing capacity and accessibility, and information about costs of upgrading and maintaining forest roads.

The Vågrust project was initiated by Skogforsk and has been carried out in close collaboration with Linköping University and several major forest companies.

CONTACT:  
Victor Asmoarp, Skogforsk | 018-18 85 54  
victor.asmoarp@skogforsk.se

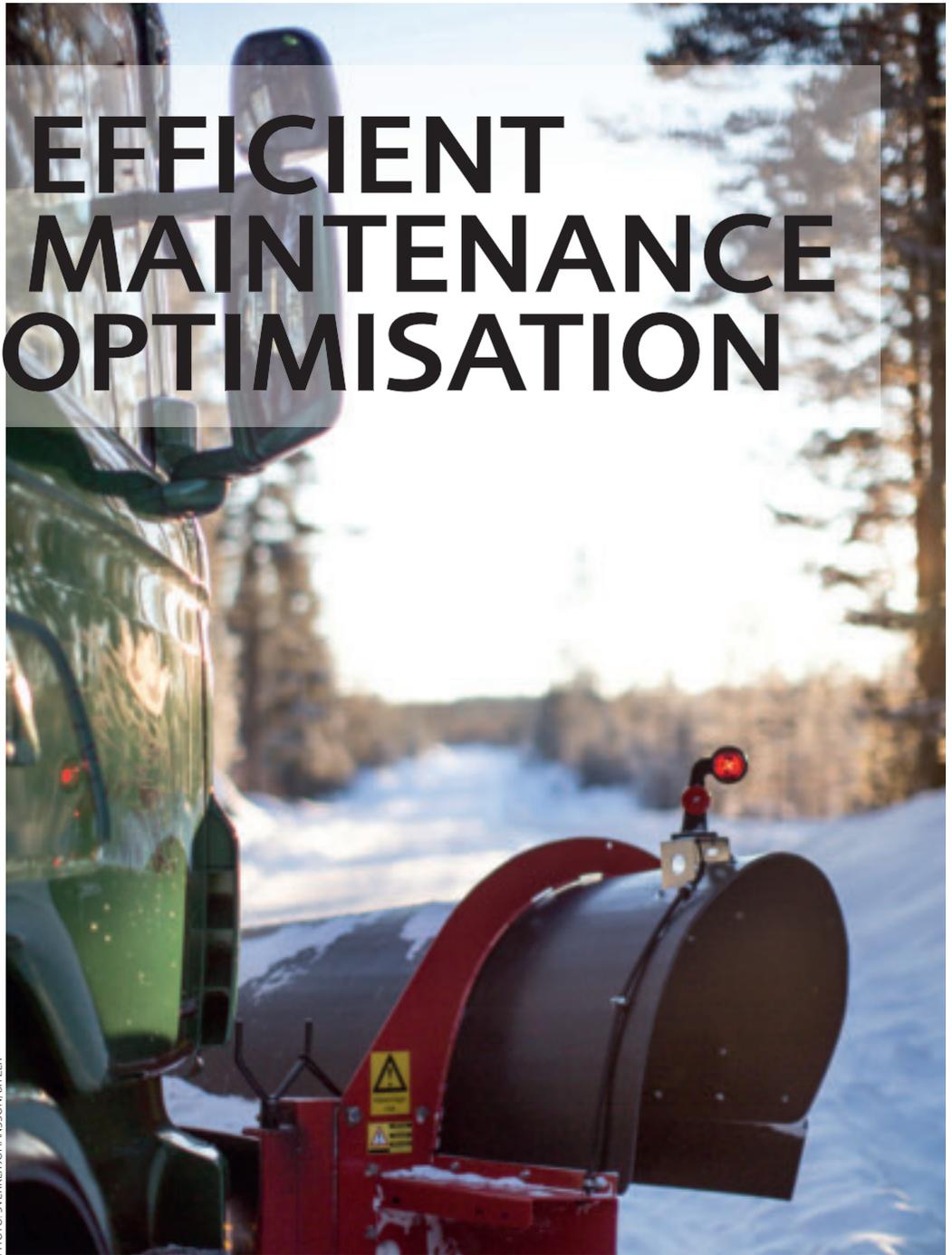


PHOTO: SVERKER JOHANSSON/BITZER

## CONTINUOUS COVER FORESTRY MORE EXPENSIVE

Where continuous cover forestry is practiced, logging is more expensive and uses more fuel than in conventional forestry with clearcuts. Logging costs are 28 percent higher, and 21 percent more diesel is used during the course of one rotation.

■ This is shown in a study where Skogforsk compared the work of forest machines in spruce dominated continuous cover stands with that in conventional clearcut forestry.

“It’s because the felling is more like thinning, and so takes considerably longer because the operator has to consider the remaining

trees,” says Rikard Jonsson at Skogforsk. “Also, in continuous cover forestry, not all the trees can be felled at the same time – the forest machines have to visit the site several times in order to harvest trees when they reach maturity”.

CONTACT:  
Rikard Jonsson, Skogforsk | 018-18 85 24  
rikard.jonsson@skogforsk.se



PHOTO: SVERKER JOHANSSON/BITZER

# SKOGFORSK PARTICIPATING IN WORK ON TARGET DESCRIPTIONS FOR CONSERVATION

Interview with Line Djupström, conservation expert at Skogforsk

## What is your role in the work on target descriptions?

“My role is to report what research really knows about different phenomena, in my case mainly about dead wood and insects. Since the SLU and Skogforsk programme Smart Tree Retention has been working with knowledge syntheses during this time, I’ve had very good support in terms of the current state of knowledge.”

## But target descriptions are a kind of negotiation product. Do you feel comfortable being a researcher in this type of project?

“Oh absolutely! My job is not to participate in negotiations between different approaches, but to objectively deliver knowledge so that the different parties have a good base for their decision making. So far in my area of expertise, I’ve not seen any compromises at all where knowledge from us researchers has been ignored.”

“For example, we seem to be getting the message across about new findings that high stumps retained on clearcuts should be

“If you leave a little of everything on one site, the result can be too little of everything!”

of the same tree species, so that resources are concentrated into favouring certain species. If you leave a little of everything on one site, the result can be too little of everything!”

## Framework

Already a couple of years ago, supervisory authorities, the forestry sector, and some non-profit organisations developed the first target descriptions for conservation, but new objectives are now being developed.

This time they concern culture stumps, pine forests on sandy soil, prevention of ground damage, and communication initiatives regarding forestry activities in recreational areas.

The target descriptions will, in practice, serve as guidelines in parts of the Swedish Forest Agency’s information and advisory services. If the content of the target descriptions, for



Line Djupström, conservation expert at Skogforsk, is participating as an expert in the forestry sector’s work on strategic objectives. Here, on an excursion outside Sala.

example sensitive habitats, are stipulated in official regulations or general guidelines under Section 30 of the Swedish Forestry Act, they will also be applied by the Swedish Forest Agency in its supervisory activities.

The road to target descriptions

has not always been completely straight. Two non-profit organisations have decided to partly or completely withdraw from the work, and not all participants were in complete agreement about all matters presented in the first report from 2013.

SOURCE: SWEDISH FOREST AGENCY

## NEW DOCTORS AT SKOGFORSK

Skogforsk researchers Per Westerfelt and Jussi Manner both completed their PhDs on 11 December. Their subjects were bees and wasps in young forests, and collection of data from forwarding.

■ Per Westerfelt is a biologist, and has been part of the Smart

Tree Retention research project. His thesis is called Bees and Wasps (Aculeata) in Young Boreal Forests. Supervisors were Jan-Olov Weslien (Skogforsk), Olof Widenfalk (Greensway), Åke Lindelöw (SLU) and Lena Gustafsson (SLU).

Jussi Manner is a forest scientist, and has worked in the Forest

Industrial Research School on Technology (FIRST). His thesis is called Automatic and Experimental Methods to Studying Forwarding Work. Supervisors were Tomas Nordfjell (SLU) and Ola Lindroos (SLU).



## READ MORE:

– Westerfelt, Per 2015. Bees and wasps (Aculeata) in young boreal forests.  
– Manner, Jussi 2015. Automatic and experimental methods to studying forwarding work.



"If you leave a little of everything on one site, the result can be too little of everything! So in a stand containing a lot of aspen trees, these trees should be prioritised – both dead and living – to ensure continuity."

JAN WESLIEN

"We must protect large forest areas and work with tree retention in production forests."

LENA GUSTAFSSON

## SMART TREE RETENTION DEAD WOOD PROMOTES NEW LIFE

Dead wood left on the clearcut provides immediate benefit to many species that depend on sunlit wood. It also provides the growing forest with more dead wood in various phases of decomposition, but the benefit varies according to the quality of the dead wood and species.

*Text & photo* SVERKER JOHANSSON | sverker@bitzer.se

**"It's good to see** that the quantity of dead wood is increasing," says Jan Weslien from Skogforsk, one of the authors of the report. "And the most important reason is tree retention in logging."

Already in the clearcut phase, the dead wood provides benefit. Many species, especially insects, want sunny conditions, so a dead tree on a clearcut can promote an insect fauna that differs quite considerably from that on a corresponding tree in the forest. This particularly applies to birch and aspen.

Researchers at Skogforsk and SLU have reviewed the scientific studies carried out since the forestry sector introduced higher levels of tree retention in the

mid-1990s. Today the effects of this conservation measure can be seen clearly.

### **New and old clearcuts**

A survey carried out in Hälsingland in central Sweden, for example, has compared clearcuts created before and after the mid-1990s. The new clearcuts had an average of 15 m<sup>3</sup> dead wood per hectare, compared with 9 m<sup>3</sup> on the old clearcuts. The change is also seen clearly in the official statistics from the Swedish National Forest Inventory's annual survey of Swedish forests; the volume of hard dead wood in young forest has doubled in the past 20 years.

"At the same time, we have a

long way to go until we reach the levels of dead wood found in undisturbed natural forest. If we want to preserve wood-living forest species, we must protect large forest areas and work with tree retention in production forests," says Lena Gustafsson from SLU, another of the authors of the report.

Which species benefit depends on the type of wood that is left. Aspen species, for example, are favoured by sunny conditions, while spruce species prefer the dead wood to be in the shade. This is why Jan Weslien recommends forest owners to find out which forest type is important in an area, and to prioritise conservation measures accordingly.

"If you leave a little of everything on one site, the result can be too little of everything! So in a stand containing a lot of aspen trees, a priority should be to leave both living and dead aspens, and in an oak landscape the emphasis should be on oaks," he says. "Sometimes, an aim may be to favour one specific species, and then it's important

to prioritise that species. A good example from research is the threatened Alaskan beetle (*Upis ceramoides*) – it has disappeared from southern Sweden, and the southerly limit seems to be constantly shifting northwards. In order to stop this retreat, effective and prioritised tree retention is needed at the southern edge of its range."

### **Scarification a threat**

But there are also threats to dead wood. Studies in Finland have shown that scarification can damage much of the dead wood lying on the ground. Swedish studies have also shown that dead trees lying on the ground often disappear in conjunction with forest fuel harvest.

"Here, it's very important that machine operators are given clear instructions so that they don't damage the dead wood in the logging site. If the dead wood is concentrated on the clearcut – preferably in connection with a retention area – this makes it clear what is to be saved," says Lena Gustafsson.

# MONITORING THINNING

## "FANTASTIC!" – GIVE US A CALIBRATION

"They've done really well with this," says Jocke Larsson. "It's amazingly accurate sometimes. But you can see how extraction in the strip roads is very important for the estimates."

*Text & photo* SVERKER JOHANSSON | sverker@bitzer.se

**Jocke Larsson** and his colleague Jakob Magnusson operate thinning harvesters for Per-Hans Skogsentreprenad in Alfta. They have been using Skogforsk's tool for monitoring thinning, hprGallring, for nearly a year.

"Here, we're working in unthinned pine forest up on the hill, while the trees in the spruce forest down by the river looks quite different. But the program still works very well for both these areas," says Jakob Magnusson.

### Good estimates

"You might think that in this type of spruce forest, where stem density is high and many trees are small, the estimate would be wrong," speculates Jocke Larsson. "Quite big spruce trees are left in relation to those we're felling. But, of course, in ten hectares of thinning, there is in practice two hectares of final felling in the strip roads, so you can understand that the program has a sizeable sample plot from which to collect its data. That should improve the quality of estimates."



Anders Lundberg,  
BillerudKorsnäs.

### No direct feedback

But the operators do not agree that the program gives direct feedback to the operator for every stand.

"No, this isn't a program you can plan your everyday work around," says Jocke Larsson. "It's more of a calibration of every operator's work for different

types of stand. But it's great that you see corrections, and realise that, ok, in a forest like this, I don't cut enough trees."

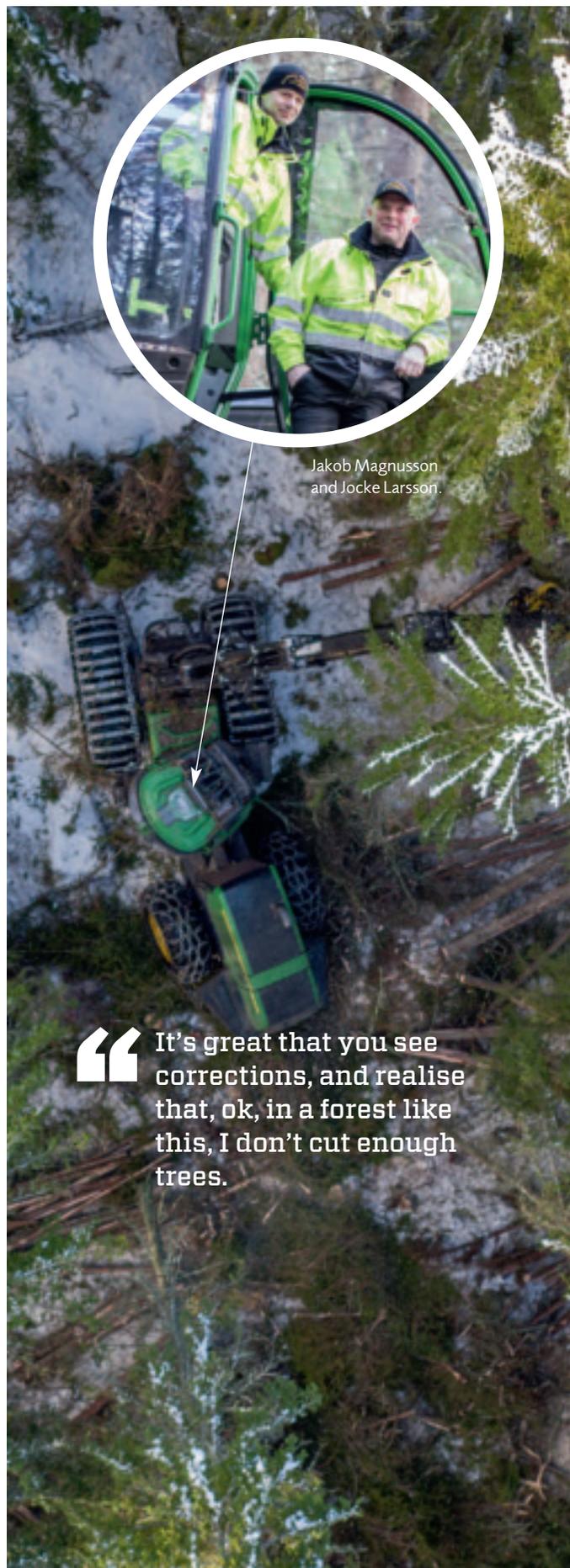
Logging manager Anders Lundberg usually works at the BillerudKorsnäs office in Bollnäs, but is out in the forest today. As things stand, he is given information about thinning on a USB from Jocke that he uses to update the stand register and forestry plans.

"But in the future I'll be getting data direct from the hpr-files that the operators send to SDC," he says. "They use the Sender XC program, so report files are sent every hour."

### No stand sub-division

One of the results of the monitoring in this area is that hprGallring suggests that the stand should be sub-divided, based on differences in top height. But Anders Lundberg does not believe it will be particularly common than suggestions are accepted when data is returned.

"No, we'll probably keep the stands together in most cases. And thinning makes the forest more homogeneous anyway. But of course, when we work through an area of completely unthinned forest, differences appear, and then the monitoring gives good data for planning sub-divisions based on a different type of management.



Jakob Magnusson  
and Jocke Larsson.

“It's great that you see corrections, and realise that, ok, in a forest like this, I don't cut enough trees.”

# "EVERYONE QUICKLY SEES AND UNDERSTANDS THE BENEFIT"

"When the program is broadly implemented, data will be sent automatically to stand registers and logging plans, I'm sure of that. And it will work in most cases. So the main question is how we assure the same quality in stands that do not fit the usual pattern."

**Anna Ahlgren** works with support systems at BillerudKorsnäs Skog and uses the hprGallring program. A number of operators working for the company are involved in the project and, after an introductory phase, are now in a position to develop everyday procedures.

#### Manual transfer of data

Even if she believes that automatic transfer of data will be needed in the future, it will not be for a while.

"What's needed at first is manual transfer of data by someone who knows the property," she thinks. "And it's most logical that the person most familiar with the forest management plan and the activity being carried out transfers the data."

#### Different procedur

However, there will be a different procedure for stands that contain such major variations

that a new sub-division is needed, or for stands that require special management.

"If, for example, you remove all the spruce trees, leaving only birches, the system won't recognise it. But, on the other hand, here we're talking about exceptions – stands aren't generally like that," says Anna Ahlgren.

#### May improve yield predictions

"I also feel that as long as the thinning takes place in ordinary stands, you get a good estimation of the species distribution, which is necessary and very important for predicting future yields. So hprGallring will probably give us much better data about what the stands will be like in the future."

#### Is it something that your timber suppliers will also benefit from?

"Yes, for forest owners with whom we have long-term relationships, we'll certainly be able to offer them a more detailed



Anna Ahlgren,  
BillerudKorsnäs

update of the forest management plans."

#### Are there any obstacles to look out for?

"No, this is mostly positive, and everyone involved very quickly sees and understands the benefit. That's great in itself," says Anna Ahlgren. "The main challenge is

to introduce automation to the data procedures. Everyone concerned must feel they can cope with this, or implementation will be slowed. We must of course use this data in the best way, but it must also be efficient. The basic idea is always to improve things, isn't it?"



**SKOGFORSK**

UPPSALA (Head Office) Uppsala Science Park,  
SE-751 83 Uppsala, Sweden Phone: +46 18 188500

EKEBO Ekebo 2250, SE-268 90 Svalöv, Sweden  
Phone: +46 418 471300

UMEÅ P.O. Box 3, SE-918 21 Sävar, Sweden.  
Phone: +46 90 2033350  
www.skogforsk.se

#### RESEARCH PROGRAMMES

FOREST OPERATIONS & PRODUCTS  
Rolf Björheden  
rolf.bjorheden@skogforsk.se  
ph. +46 18 188509

OPERATIONAL PLANNING & LOGISTICS  
Gert Andersson  
gert.andersson@skogforsk.se  
ph. +46 18 188567

FOREST ENERGY  
Mia Iwarsson-Wide  
maria.iwarssonwide@skogforsk.se  
ph. +46 18 188599

SILVICULTURE & ENVIRONMENT  
Isabelle Bergkvist  
isabelle.bergkvist@skogforsk.se  
ph. +46 18 188595

TREE IMPROVEMENT NORTH  
Bengt Andersson  
bengt.andersson@skogforsk.se  
ph. +46 90 203 3358

TREE IMPROVEMENT SOUTH  
Bo Karlsson  
bo.karlsson@skogforsk.se  
ph. +46 418 471305