



# Health and Performance in Mechanised Forest Operations



**Editors:** Sten Gellerstedt, Swedish University of Agricultural Sciences  
Ewa Lidén, delo – Organisationsberatung, Germany  
Folke Bohlin, Swedish University of Agricultural Sciences





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## Preface

This handbook Health and Performance in Mechanised Forest Operations is a result of an EU project titled Ergoefficient mechanised logging operations (ErgoWood).

Partners from France, Germany, Norway, Poland, Sweden and United Kingdom have been involved. Reference groups in each country have given contributions. The reference groups were made up of machine operators, machine owners, trade unions, contractor associations, forest owners and forest companies, as well as machine manufacturers, health and safety authorities and researchers.

Over 350 machine operators in the six participating countries have provided the foundation for the research in the development of this publication by responding to questionnaires and interviews on their social, safety and health situations. Without their inputs the production of the publication would not have been possible.

This handbook is partly in conformity with the EC Directive 89/391/EEC: Introduction of measures to encourage improvements in the safety and health of workers at work, which affects all companies involved in forestry. The handbook takes the parts of the directive, regarding work environment policy, distribution of tasks, external expertise and written risk assessment into account. The procedures recommended in this handbook will contribute in fulfilling the social element in a forest certification system.

The project ErgoWood was co-financed by the European Commission programme Quality of Life and Management of Living Resources – QLK5-CT-2002-01190.

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This handbook is built up in two parts. The first part describes a continuous process in five steps to improve health and performance in mechanised forest operations.

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In the second part there is a number of tools for your assistance. The tools are adapted to the situation at the forest work place.

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## Improving health and performance

”Of course I may improve. It is only to work harder. But there is not much left to take, and I have a life beside as well” (Comment from a harvester operator).

Health and performance have been kept as separate issues for too long. Seeing the connection between the two offers hope, a solution might be not to work harder but to be better organised. To stay profitable companies and teams need a method for detecting early signs of operator ill health or lost motivation. Such a method also has to give guidance on how to prevent or react to problems.

### For people using forest machines

This handbook provides guidance for teams, contractors and 1<sup>st</sup> line managers in mechanised forest operations on improving and maintaining the operators’ health, safety and well-being.

The guidance is based on research and established practices of people using forest machines. The focus is on the human factor, which often is overshadowed by technical discussions - despite the fact that the operators are most important for the final outcome.

### Health makes profit

Costs due to working whilst ill and absence from work are not always visible. The operators and their families first experience the effects of the illness. Then there will be reduced performance, maybe followed by pronounced illness and absence from work. In the worst case the operator leaves the business. By improving the work, the following costs might be reduced:

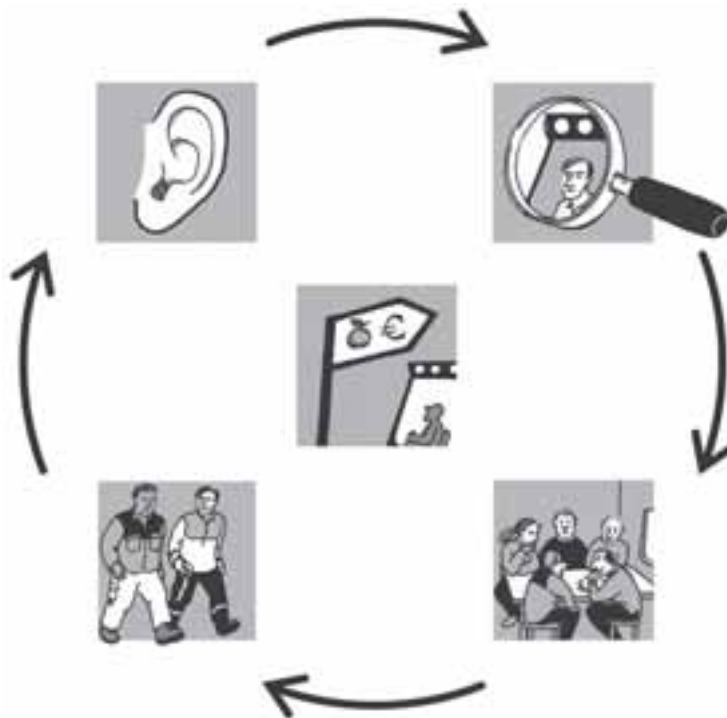


- When working whilst ill, the cost is the operators’ failing health and reduced performance. If we count 215 machine days in an average year, ten percent lost from reduced performance results in 21 days of lost production per year.
- When an operator is absent due to illness and without a replacement the machine will stand still. The cost will be the total production value less variable costs.
- If the illness is long-lasting there is a need for a new operator. There are increased costs from recruitment and training. If it takes one year for a harvest operator to improve from 50% to 100% performance, the production loss could be 3 months.

Can it be profitable for the team to regularly identify problems and find solutions together? Properly scheduled, these discussions can take place during machine down time. Personnel costs being about one third of production value indicates that one hour gained in increased production time is good for two hours discussion time.

## Five steps for managing health and performance

- 1 Develop a policy and routines.** An essential framework for operators' performance, safety and health is a policy concerning working conditions and routines for management of the human factors. The outcome of the policy should regularly be discussed within the team. The policy, the routines, the risk assessment and the action plan should be written down, enabling them to be managed.
- 2 Assess risks.** When larger changes to the activity are being planned or if work has an assumed risk, a health risk assessment should be performed. If a team meets problems of low performance, ill health, accidents, or severe incidents the causes should be investigated. Findings should be discussed within the team.
- 3 Find solutions.** The team should be involved in developing the solutions. While doing this, attention should be paid to how changes and variations are managed. Measures should be prioritised.
- 4 Implement.** Measures and solutions should be agreed and carried out. Measures which cannot be fulfilled immediately should be entered into a plan. The plan should have a clear scheduling, indicating priorities and the persons responsible. A budget should be applied to each measure.
- 5 Follow up.** The results of the accomplished measures should be monitored as well as the fulfilment of the plan. Key indicators should be used that verify accomplishment or the necessity of further actions, e.g. revisions of routines.





# 1. Policy and routines

The time spent on management of the work environment can achieve considerable benefits. A contractor with sound working conditions obtains a good reputation and is seen as a reliable supplier of harvesting services. He will also recruit and keep competent operators more easily.

The operators' well-being is a necessary part of business development. Some goals and routines can be combined to reduce health risks and improve profit.

## Policy

A policy is a mutual manifestation of the will within the company. It shall be concrete and easy to understand. It should start with the risk inherent in the activity.

The policy can consider the crewing, including work-shift scheduling, job rotation and calling in additional operators. Improving operator skills enabling rotation between machines and ground based work is also an item for the policy, as well as having up to date machines. A policy should be a part of the business idea.

### A business idea including a health policy

We are a trustworthy supplier of logging services. We focus on:

- Developing a profitable and sustainable business,
- keeping the right level of competence for all personnel,
- keeping our operators healthy and alert,
- having good business practices,
- positioning ourselves one step ahead in the development.

Customers choose us, since we create value for them.

Our achievement is a result of a good team spirit based on good co-operation between team members and the contractor. Our team is highly motivated since a sound business creates safe work, employment and proper pay. We are performing well since:

- Working instructions are clear, we monitor our own work,
- delegation of authority to operators enables fast reaction to change,
- we get feed-back throughout the business and from our customers,
- we have a fair objective wage system facilitating development,
- we have the freedom to decide upon working hours (within agreed constraints),
- we have up-to-date machines with cost efficient equipment,
- site preparations are good.

Your policy may include matters such as being alert when operating the machine. This means that the operators are fully rested when starting the shift, and without aches and pains when ending it. To achieve that, the work has to be organised to enable full recovery during a 24-hour period. A measurable target could be that the operator does not need extra rest or sleep after work or at weekends.

The policy should state who is involved in the management.

## Routines

Your routines should indicate for whom, when, how and by whom work environment management is to be conducted.

Base the work on existing routines and try to develop key indicators, able to catch early signs of ill health and reduced performance. You might use records for payment and sick leave, site inspections and machine maintenance. These means for the follow up have to be developed by the team. The findings should be discussed at regular meetings.

## Indicators of change

You can follow up operator performance by monitoring:

- Harvested volume,
- machine availability,
- fuel consumption, and
- if more mistakes come about towards the end of the work shift or the week.



These indicators reflect the operators' performance, which depends on their well-being and motivation. How? A tired operator uses more fuel per cubic metre of wood harvested and the machine utilisation is lower for someone who is ill.

More direct indicators on health are:

- Stiffness, aches or pain in the neck and shoulders,
- accumulating fatigue at the end of the day or during the week-ends, and
- sleeping problems, aches and pains in the head or stomach.

Depending on the situation in the team the indicators may be assessed per week or per month or other agreed time periods.

## To discuss in your team

- How does operator health influence profitability in your team?
- How does your company handle operators' early symptoms of illness?
- Who is responsible for establishing policies and routines regarding health?
- Does the team meet regularly to discuss topics of current and future interest? Have you ensured that the supervisor/contractor is present?
- Is work organized with clear responsibilities?
- Have you discussed how good quality and safety can be rewarded?
- Do you have methods to monitor your routines and decisions taken?





## 2. Assess risks

What makes operating a forest machine attractive? It can be the use of modern technology, high production, and to work in a nice cab allied to working outdoor within a team of likeminded colleagues. However, time pressure, accidents and illness can spoil the satisfaction. The particular hazards in forest machine operating include:

- Long operating hours in fixed seated positions with continuous repetitive hand, arm, and head movements,
- high levels of attention,
- whole body vibrations, bumps and
- inclined seating.

Working alone, shift work and production pressure, enhances these hazards. Risks are increased if instructions are unclear or if equipment is missing or not kept in good condition<sup>1</sup>.



### How to classify risks for ill health and accidents

Most risks are best classified when identified and expressed by the team. The team needs to discuss this regularly at ordinary meetings. Examples of risks are missing handholds for use when cleaning the lighting, conflicts on machine maintenance and neck pain. Let the team classify the urgency as:

- |         |  |
|---------|--|
| Green:  | The risk is negligible.                    |
| Yellow: | The risk requires action within some time. |
| Red:    | The risk requires immediate action.        |

The policy can help setting of priorities. Health issues may be difficult to assess for the lay person. A competent occupational health service should be contracted if you have recurrent problems. Contact your branch organisation if you are unsure of what service to engage.

### Document your findings

You should keep notes; with this process you might identify problems which have existed for long periods without being resolved. Some actions just do not get to the point of execution; documentation will improve implementation of actions.

<sup>1</sup>If you want to check your machine in detail please refer to tool 8: European ergonomic checklist for forest machines.



## To discuss in your team

- Do team members experience:
  - stiffness, aches or pain in the neck and shoulders more than once a week?
  - being over tired at the end of the day more than once a week?
  - being over tired during leisure time?
  - sleeping problems more than once a week?
  - aches and pains in the head or stomach at periods with high work intensity?
  - troublesome time pressures?

Please refer to - Tool 2 at page 22  
**Health indicators**

- How do you investigate risks at work?
- Do you experience increasing numbers of mistakes towards the end of the work shift or the working week?

Please refer to - Tool 4 at page 27  
**Assessment of work shift rosters**

- Which situations and tasks involve the largest risks?

Please refer to - Tool 1 at page 20  
**Assessment of work organisation and job satisfaction**

- Is work planned and managed in an effective way with regard to health and performance?

Please refer to - Tool 9 at page 41  
**WORX – make strengths and weaknesses in your work conditions visible**

- Have you made an estimation of how much illness and reduced performance might cost?

Please refer to - Tool 5 at page 31  
**Costs of illness and preventive measures**

- Are machines and equipment up to standard on factors affecting health? Do the machines fulfil recommended ergonomic standards?

Please refer to - Tool 8 at page 40  
**European ergonomic checklist for forest machines**



### 3. Find solutions

Finding solutions is a task for all involved; the contractor, the supervisor, the operators, and in some cases the customers. By neglecting problems or aversion to change in this process, the result might be delay and even failure.

In the search for solutions you usually need to combine several measures; technical (e.g. new seat), individual (e.g. education), organisational (e.g. shift scheduling) and management measures (e.g. allocation of responsibilities). Take your time, since if this phase is forced, you may end up addressing the symptoms rather than the problems. If you focus on the future, not only on the immediate problem, it might be possible to satisfy goals which at first seem to be conflicting.

The communication at the work place must be open and simple. An open climate is not self-generating, but needs to be consciously developed.



#### Examples of activities

Aches and pain in the neck or shoulders is common among machine operators. How do we solve that? The most important is to start remedial activities, document changes and follow up. Possible activities are:

- Micro pauses and rest breaks
- Evaluation of the operator's working postures and movements by a physiotherapist or an ergonomist
- Training in work technique including good working postures
- Reduction of the amount of machine work
- To exploit your unique knowledge about your region. Contact forest owners and wood buyers to find out if they are interested in contracting new services, which enable tasks outside the machine for the operators
- Staff-sharing between employers with different work tasks, e.g. to alternate between machine operation and tourism at different seasons.

In the long run an operator developing pain has to work fewer hours in the cab and do other work tasks instead. These tasks, however, have to be sufficiently remunerated.



## To discuss in your team

- How can you and your company avoid work related illness?
- Could the overall efficiency benefit from having broader tasks in the team? What tasks? How would efficiency increase?

Please refer to - Tool 3 at page 24  
**Tasks for job enlargement**

- Are there special competences in the team, which can be utilized to develop new businesses? Carry out an inventory of the operators' competences and interest.
- Which tasks really have to be carried out by the supervisor? Why?
- Is work organised according to individual operators' requirements?

Please refer to - Tool 4 at page 27  
**Assessment of work shift rosters**

- Do you trust each other regarding maintenance and other mutual tasks?
- How could the understanding between the harvester and forwarder or skidder operators be increased?
- Should operators concentrate on one machine and not do additional tasks? Why? In a short or a long perspective? Are there any 'costs'?
- What are the short and long term costs and benefits of different measures? What are the direct and indirect costs and benefits?

Please refer to - Tool 5 at page 31  
**Costs of illness and preventive measures**



## 4. Implement

Good intentions have often failed because of adherence to old habits and since the measures were not accepted as being necessary. With a mutual idea of the future within the company (see Step 1), actions have a better chance to bring about change and improved revenue.

Operators perform well when they can actively influence what, how and when to work. But this is not enough. They also need to feel part of a social grouping with both work mates and superiors.



### Document activities

Agreed measures, which are not carried out immediately, should be scheduled and documented in a plan. This enables a follow up and improves the chances for completion. The documentation can be summarised in an agreement specifying:

1. The activity you are going to carry out.
2. The goal and why the activity will be undertaken. Define key indicators (see Step 1).
3. A scheduling of start, end, follow up and sub-targets dates.
4. Affected persons, persons responsible for actions, and external help (if needed).
5. Sanctions to be taken if the activity is not carried out.
6. Costing and financing of the activity.

## An example

One operator suffers from neck pain and another feels very tired after work and at week-ends. A medical examination prescribes a training program.

- At a team meeting it is decided to undertake a training program at the local fitness centre. All operators may join. Working out once a week is agreed upon.
- The goal is to improve fitness and co-ordination of muscles and joints.
- A six-month training programme will be provided with a follow up afterwards.
- The operators will contact the fitness centre individually.
- The company will pay the costs.

## To discuss in your team



- Which are your new responsibilities? Are corresponding authorities delegated?

Please refer to - Tool 6 at page 38  
**Protocol for assignment of responsibilities**

- How does your company document activities decided upon?

Please refer to - Tool 7 at page 39  
**Template for documentation of an activity**

- How can the entire team be involved in the development process?
- How do you agree on which activities to start with? How is it resolved if team members have different aims?

Please refer to - Tool 5 at page 31  
**Costs of illness and preventive measures**

- Do you actually listen to each other and consider opinions and suggestions? Are the operators' points of view actually taken into consideration?
- Is the communication within the team and in the company open? Do you need external support or to carry out communication training?



## 5. Follow up

**... just as an operator assesses his machine from listening to its sound, so may the team learn to diagnose their well-being by talking about it and listening to each other.**

There are many reasons why a decided activity is not carried out, or why other results than anticipated are received. Without follow up, mistakes might be repeated.

In Step 1 'Policy and routines' indicators were introduced as a means for monitoring health and performance. The use of health indicators is a way of measuring, guiding and learning about the actions taken and their effects. To see how the health indicators develop, they have to be assessed at least three times.

- ➔ If indicators show positive development: Continue process to improve even more!
- ➔ If indicators show nil or negative development: Find reasons, search new solutions, and assign new priorities and responsibilities. When necessary, change routines.



### ... the example

Following up on the example from Step 4 (p. 14), it was found that two out of four operators regularly exercised at the fitness centre. One of them was the operator who used to be very tired and he claimed improvements.

Has the action been successful? The operator who feels less tired says yes. The employer also says yes. Improved fitness will yield increased performance at a rather low cost.

The degree of success in this example will depend upon the view taken. If the team has decided on having 'not feeling tired during leisure time' as a key indicator, there has been an improvement. If they defined the key indicator as 'minimising illness', the activity in this example has not yet proved successful. The follow up must then be continued and new actions taken in line with the company policy.



## To discuss in your team

- Which health effect does the team want to follow up?  
Can it be turned into a key indicator?
- What actions have been taken and why?
- Has the measure proposed been applied and achieved the intended result? If not, why?

Please refer to - Tool 1 at page 20

**Assessment of work organisation and job satisfaction**

Please refer to - Tool 2 at page 22

**Health indicators**

- Has operators' performance been affected?
- What was experienced as positive? What was negative?
- Have any other effects occurred, good or bad?
- What did you learn? How can you ensure the experiences are used?
- Were the resources sufficient (money, knowledge, time, personnel)?
- What is the next step for the work improvement?
- Do you have a system to 'close' a site, i.e. an opportunity to discuss problems encountered and potential solutions for future situations?
- Is there a need to change routines?

**If a follow up reveals problems you might need to assign new priorities and responsibilities. You may also have to go back and change the routines.**



## Section 2 – Tools

The tools presented in this handbook have been developed for solving different problem situations in mechanised forestry work covered in part 1.

Working with the tools does not require specific knowledge, but personal experience from day-to-day work is necessary.

### General recommendations for working with the tools:

1. Appoint one responsible person or a responsible development group.
2. Customise question sheets and templates with your logotype if appropriate.
3. Print the necessary number of copies.
4. Gather all involved, operators and contractor/supervisors, and explain and agree upon why a tool should be used.
5. Discuss and decide what and how e.g. what data will be collected and how it is to be analysed.
6. Agree upon when the results will be presented and discussed.

### List of tools

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# 1. Assessment of work organisation and job satisfaction

Circle **one** alternative of your choice for each question.

**1. To what extent can you decide yourself how to perform your work?**

- 5 To a high extent
- 4 Rather high extent
- 3 Some extent
- 2 Rather small extent
- 1 To a small extent

**2. How would you describe your work?**

- 5 Varied and consisting of many work tasks
- 4 Rather varied
- 3 It can be both monotonous and varied
- 2 Rather monotonous
- 1 Very monotonous

**3. Specify how much you agree with the following within your company/organisation: "Tasks are systematically altered to reduce the machine operating hours."**

- 5 Yes, absolutely
- 4 Yes, probably
- 3 Uncertain
- 2 Probably not
- 1 Absolutely not

**4. Are you able to take breaks during the day when you feel the need to?**

Seldom 1 2 3 4 5 Anytime

**5. How is the working pace on average during a working day?**

High 1 2 3 4 5 Low

**6. To what extent do you think your work is interesting and stimulating?**



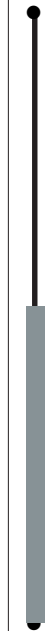

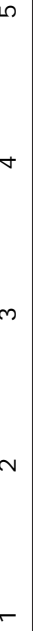
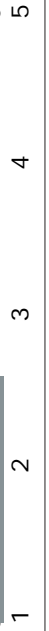

- 5 To a high extent
- 4 Rather high extent
- 3 Some extent
- 2 Rather small extent
- 1 To a small extent

**7. How do you usually feel about your work on your way there?**


- 5 Good and content at the thought of the interesting work that awaits me
- 4 Positive at the thought of work
- 3 Neither positive nor negative at the thought of work
- 2 Some uneasiness at the thought of work
- 1 Strong uneasiness at the thought of work

## Data processing sheet

Enter the value for each question and operator (op.) into the table, calculate the mean for the working group and mark it on the scale to the right.

Question	Op. 1	Op. 2	Op. 3	Op. 4	Op. 5	Op. 6	Op. 7	Mean	Mark and check if outside the grey zone
1. Self decide how to perform work									
2. Variation at work									
3. Systematically altering of tasks									
4. Take breaks when feel like									
5. Working pace on average									
6. Work is interesting and stimulating									
7. Feelings on the way to work									

## How to proceed with the results

The grey zone  indicates 'unsatisfactory' values, i.e. indicates need for actions. The grey zones are related to average values from machine operators in six European countries, supplemented with experiences from other trades. If you consider taking measures you will find guidance in the main text of this handbook and references to further tools.

It is suggested that you repeat this survey at intervals to assess how the situation in your company develops. You can either do it at fixed times, e.g. every six months, but you may also repeat the survey for the follow up of new activities in the team/business.

For you who want to find out more about the current situation and get detailed indications where to invest time and resources in improvement activities in your team we recommend tool 9: WORX – make strengths and weaknesses in your working conditions visible.

## 2. Health indicators

Circle **one** alternative of your choice for each health complaint and question.

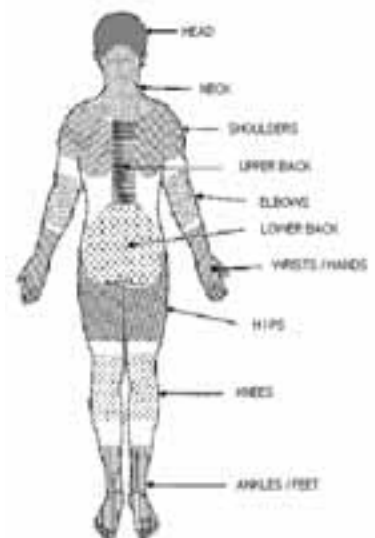
### 1. Have you, during the previous 12 months, suffered from work related symptoms:

	Never	A few times	A few times per month	A few times per week	Almost every day
Headache	5	4	3	2	1
Sleeping disorders	5	4	3	2	1

### 2. Have you suffered from any work related symptoms (*ache, pain, discomfort*) in one or more body regions (see picture) during the previous 12 months?

	Never	A few times	A few times per month	A few times per week	Almost every day
Neck	5	4	3	2	1
Shoulders	5	4	3	2	1
Upper back	5	4	3	2	1
Elbows	5	4	3	2	1
Lower back	5	4	3	2	1
Wrists/hands	5	4	3	2	1
Hips	5	4	3	2	1
Knees	5	4	3	2	1
Ankles/feet	5	4	3	2	1

Body regions



### 3. When do you consider yourself fully recovered after a working day?

After a night's rest	After a week-end	After a week off or more	After a longer vacation	Practically never
5	4	3	2	1

## Data processing sheet

Complaint	Date	Op. 1		Op. 2		Op. 3		Op. 4		Op. 5	
Headache											
Sleeping disorders											
Neck											
Shoulder											
Upper back											
Elbows											
Lower back											
Wrists/hands											
Hips											
Knees											
Ankles/feet											
Recovery time											

## How to proceed with the results

It is suggested that you repeat this survey at intervals to assess how the situation develops. You can either do it at fixed times, e.g. every six months, but you may also want to repeat the survey for the follow up of new activities in the team/business.

If complaints – take action! There are advice and suggestions in this handbook.

### 3. Tasks for job enlargement

Most people say there are only machine operations in mechanised harvesting work. Is that true? This tool is designed to give you guidance in finding tasks, which could be integrated into forest harvesting work.

- The purpose is to increase the variety at work and hence to decrease the repetitiveness and monotony of machine work.

The tool is developed as guidance for discussions among harvesting team members and their supervisors on effective use of competence and sound distribution of tasks within the team.

#### A list of different tasks

Work tasks listed below might occur in timber harvesting teams.

Tasks connected to machine work	Further tasks ...
Operating more than one forest machine	Control and follow-up, like ...
	... biological
Long term harvesting planning	... silvicultural
Environmental concerns	... ecological
Preparations, like ...	... economical
... inspection of sites	
... marking of bounds	Discussions about harvesting contracts/deals
... marking of strip roads	Contact with supervisors
... calculation of thinning grade	Contacts with customers
... marking of trees	Contact with the public
... grading	
... operational planning	Silvicultural planning
... preparatory cleaning	Administrative work
Calibrating measuring equipment	
Move the machine between sites	Manual work, e.g.
Maintenance	... power saw cutting
Repairs	... planting
Sharpen chains	... weeding
Order supplies and spare parts	... fertilization of stands
	... tree pruning
Mechanised silviculture, e.g.	... cleaning in young stands
... soil preparation	
... planting	Long distance transport of wood
... sowing	Other lorry transports
... fertilization	Operating other contracting machines
	Wood trade and procurement
Measuring the stacked volume	
Marking of special assortments	Seasonal work in additional industries
Reporting harvested volumes to wood owner	Road maintenance
Public safety/traffic safety	

**You might carry out other important tasks at your work place. Add them on!**

## An example

In the example below an operator is working half of his machine time as a harvester operator and the other half as a forwarder operator; in total 40 hours in a 5 day working week. In addition, closely tied to the machine operations, he carries out 6 hours each week on machine maintenance. Some hours each week are also spent with work planning, such as marking of site boundaries and strip roads, with motor manual pre-cleaning, and with follow up of harvesting work. These tasks make up for 30% of his working time.

	Task	No. of hours							Tot	%
		Mo	Tue	Wed	Thu	Fri	Sa	Su		
Main task 1	Harvester operating	6	6	2					14	35
Main task 2	Forwarder operating			2	6	6			14	35
Side task 1	Machine maintenance	1	1	1	1	2			6	15
Side task 2	Planning of sites			2					2	5
Side task 3	Pre-cleaning	1	1						2	5
Side task 4	Follow up work			1	1				2	5
<b>Total:</b>		<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>8</b>			<b>40</b>	<b>100%</b>

## How to use the tool

Let each team member identify their own work tasks using the template on the next page. Which are the one or two main tasks? What other tasks are carried out? How many hours each day or each week are used for each task?

It is also important, using the template provided, to identify your further competences, which could be useful to customers and generate additional work and payment.

## How to proceed with the results

Compare each team members list of tasks. Consider the following issues together:

- Are there special competences in the team, which can be utilized to develop new businesses? Make an inventory of the operators' competences and interest.
- Are there tasks left out that none of you say you do, but which in fact are performed?
- Are there tasks that none of you really do, but which need to be carried out?
- Do any of you prefer some specific tasks?
- Do all of you prefer the same tasks?
- Are there any alternative ways of sharing the tasks that you can identify, in order to get a more efficient as well as more varied work?
- Does someone need additional training to be able to carry out new tasks?

Agree upon an efficient and sound distribution of tasks. Use tool 4 to elaborate suitable shift rosters.

# Template for assessment of work tasks

Name of operator: \_\_\_\_\_

Task		No. of hours								%
		Mo	Tue	Wed	Thu	Fri	Sa	Su	Tot	
Main task 1										
Main task 2										
Main task 3										
Side task 1										
Side task 2										
Side task 3										
Side task 4										
Side task 5										
Side task 6										
Side task 7										
Side task 8										
Side task 9										
Side task 10										
Side task 11										
Side task 12										
Side task 13										
Side task 14										
Side task 15										
Side task 16										
<b>Total:</b>										<b>100%</b>

Other qualifications and competences: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## 4. Assessment of work shift rosters

A method to identify work load is to calculate work load points<sup>1</sup> (WLP). During work the machine operator accumulates work load points. More points mean more effort and fatigue. To recover it is necessary to rest or to do something else, like manual work or to take a longer break. Combining machine work with some hours of physical manual work has been shown to be good.

- With this tool you get a basis for discussions on health implications of different working rosters you already use or those you might switch to.

### How to calculate work load points

By assigning work load points you assess the impact on your body from your shift rosters. It is suggested that the team work through the examples together with the contractor/supervisor to get used to the method before calculating and elaborating their own shift rosters.

- The first working hour in a harvester gives 0 points; the next 1 point; then 2 points; and so on.
- The first working hour in a forwarder gives 0 points; the second and third hours give 1 point each; the fourth and fifth 2 points each; and so on.
- One hour of physical manual work after working in the cab gives minus 2 points; the next two hours give minus 1 point each; the following hours give 0 points each. Notice: If you start a shift doing manual work you cannot accumulate negative points.

Task	Consecutive hour of work							
	1	2	3	4	5	6	7	8
Harvesting	0	1	2	3	4	5	6	7
Forwarding	0	1	1	2	2	3	3	4
Manual work	-2	-1	-1	0	0	0	0	0

- Less than one full hour of break has no effect. One full hour of break reduces the following machine hour work load by 1 step; two hours reduce the following machine hour by 2 steps; and so on. However, you still keep your accumulated points from the previous work.

<sup>1</sup>The method has been used at the forest industry companies Sveaskog and StoraEnso in Sweden for harvester and forwarder work. It was originally developed by Jan Adolphsson, Human Resource Manager at the Forest Division of StoraEnso.

## Example 1. A team of three operators (A, B, C), a harvester and a forwarder

Maintenance work is conducted in the middle of the working day.

 Harvester  
  Forwarder  
  Manual work  
  Break

Operator Working hours	Hour of the day																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	WLP	
A; 6-15h						█	█	█	⊕	█	█	█	█	█	█	█									1
WLP						0	1	2		-2	-1	0	1	1	-1										
B; 9-18h										█	█	█	█	█	█	█	█	█	█						3
WLP									0	1	2		-2	-1	0	1	2								
C; 6-15h						▨	▨	▨	⊕	▨	▨	▨	▨	▨	▨	▨									9½
WLP						0	1	1	2		1	2	2	2	1½	-1									

Operator A starts his working day at 6:00 am operating the harvester for 3 hours. At 9:00 am he takes 1 hour break followed by some manual work for 2 hours. He might do planning work thus walking through the site causing him some physical effort. At noon he takes over the harvester again operating it for 2½ hours. Operator B starts working at 9:00 am taking over the harvester from operator A. At noon he takes a 1 hour break followed by 1½ hour of manual work on his own. Perhaps he does preparatory cleaning. At 2.30 pm operators A and B work together for ½ hour doing maintenance work. Operator A finishes his working day at 3:00 pm. Operator B finishes his working day at 6:00 pm after 3 more hours of machine work. Operator C starts his working day at 6:00 am. He operates the forwarder all the day interrupted by 1 hour of break in the middle of the day. He finishes his working day at 3:00 pm after ½ hour of maintenance work.

In this example the forwarder operator reaches the highest work load of 9½ points. The harvester operators reach 1 and 3 points respectively.

### How to improve

What could be done about the forwarder operator’s work load? One way could be to rotate between the different machines thus in the longer run even out the differences between the three schedules. An even better solution could be to let also the forwarder operator do some interrupting manual work during his working day.

### Example 2. Two operators (A and B), a harvester and a forwarder

Maintenance work is conducted at the end of the working day.

 Harvester
  Forwarder
  Manual work
  Break

Operator Working hours	Hour of the day																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	WLP	
A; 7-15.30h																									23½
B; 7-15.30h																									13

Operator A starts his working day at 7:00 am operating the harvester for 4 hours. At 11:00 am he takes ½ hour break followed by harvester operating for another 3½ hour. At the end of the day he does maintenance work for ½ hour. Operator B starts working at 7:00 am operating the forwarder. At 11:00 am he takes ½ hour break followed by another 3½ hours forwarding. At the end of the day he does maintenance work for ½ hour. Both operators finish their working day at half past 3.

In this example the harvester operator reaches as much as 23½ points. However, the forwarder operator reaches 13 points, which also is a rather high level.

#### How to improve

What could be done about it? Just rotating between the machines every second day or week would probably not be enough in this case but would be a first step. To reach lower work load levels the operators need interruptions in the machine operating. They need to find valuable tasks beside machine work. They could use tool number 3 in this handbook: 'Tasks for job enlargement' to identify tasks, which could promote their finding alternative tasks.

## Assess your own work load

Calculate your own work load points as in the examples. If you have different schedules different days or weeks you should calculate your work load for the different alternatives. Comparing your different schedules you should be able to grasp the long-term influence.

Operator Working hours	Hour of the day																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	WLP	
A;	Task																								
	WLP																								
B;	Task																								
	WLP																								
C;	Task																								
	WLP																								
D;	Task																								
	WLP																								
E;	Task																								
	WLP																								

### How to proceed with the results

Compare different outcomes and try to find the best solution for you and your team. Everyone has an individual tolerance to workload. It is thus not possible to tell at what point someone will develop health complaints. However, a target should be for all operators to keep the work load at reasonable levels. Consider the following issues, while discussing your future shift system:

- ➔ Could the different tasks be distributed in alternative ways thus reducing the work load of individual operators?
- ➔ Could more tasks other than machine operation be added to the total work tasks of the team thus giving possibility to a more varied work?
- ➔ Could work be organised in a different way thus reducing the total work load?

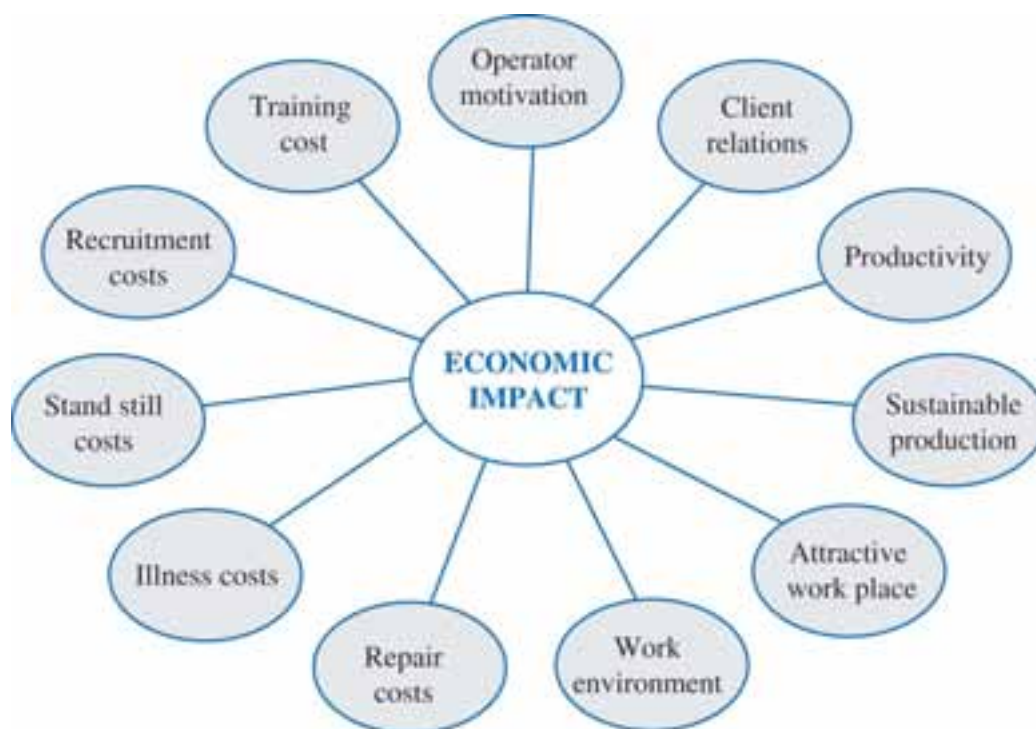
Use the tool number 3: 'Tasks for job enlargement' to find tasks, which could promote a reduced work load.

## 5. Costs of ill health and preventive measures

Good health yields benefits, illness incurs costs. There is an old saying that "good ergonomics is good economics". But estimating the profitability of investments to prevent work related ill health is difficult since we cannot calculate a price for an aching back or recurrent headaches. What we can do is to see if prevention investment costs can be recuperated by the company through decreased illness costs and/or increased productivity. This is what this tool is all about.

In the next section we will first appraise company economic benefits of good health, then company costs due to ill health. Lastly we examine an investment room for preventative action by setting the costs of a proposed measure in relation to its proposed benefits in improved performance and evaded costs.

Effects of ergonomic investments frequently go beyond the original intent. Consequences may be difficult to see and to evaluate. You need to try to appraise as many consequences as possible.



Good health means that the operator feels motivated, alert and rested, with no reduced mobility due to pain, no headache or other illness. In the following examples we consider that the health aspect yields a 5% performance gain. The forest operation we consider is a two shift operation in final felling with a machine utilization of 80%.

Company costs due to illness vary according to staffing, severity of illness and production load. Many different scenarios are possible; in the examples we focus on four common illness cases.

**According to a survey almost 20% of 358 investigated European machine operators in six countries reported working while ill for up to 1 week. Another 20% worked while ill for more than one week.**

## How health and illness influence performance

(from calculations in the tables 3 and 4-7, see pages 34, 35, and 36)

### Three ways good health increases productive machine hours – from table 3

#### Gross machine availability

is the calculated yearly utilization rate of the machine after deductions for holidays, training, illness and other known causes for production stops. If the absence due to work related illness is reduced, yearly utilization rates improve.

Every gain of a day not lost by sickness renders an additional 7.5 productive hours per year.

- **Economic benefit: 525 €/year**

#### Net machine utilization

refers to the availability of the machine in daily operation. Stressful situations or reduced mobility of the operator may lead to poor machine operation and production stops, i.e. reduced availability. Based on 2000 hours initial net machine availability:

5% increased net availability render an additional 100 productive hours per year

- **Economic benefit: 7,000 €/year**

#### Operator performance

in the forest stand is the key to high productivity. A good productivity in a clear cut might be 20 m<sup>3</sup> per hour. With good work organization and proper ergonomics:

5% improved performance translates to a production increase of 15 m<sup>3</sup> per day (15 hours \* 0.05 \* 20 m<sup>3</sup>) or 0.75 hours production time per day. With 215 production days each year, this corresponds to a yearly production gain of more than 160 hours.

- **Economic benefit: 11,200 €/year**

### Four ways illness generates costs – from tables 4-7

#### The operator continues working whilst ill

The costs will be confined to the individual's own deteriorating health and reduced performance.

- **Cost of reduced production: 525 €/week**

#### The operator is ill and absent from work, but there is a replacement available

Costs may include sick pay, additional personnel costs, and maybe reduced performance of the replacement.

- **Cost of reduced production: 487 €/week**

#### The operator is absent due to illness and there is no replacement

Minimum costs are equivalent to the profit contribution; the production value less variable costs, costs may include sick pay.

- **Cost of 1 weeks lost production: 2,625 €/week**

#### The illness is long-lasting

The company may have to recruit a new operator, which will entail both recruitment costs and may also involve training costs. Personnel costs are made up of sick pay, additional personnel costs, rehabilitation, recruitment and training costs.

- **Cost of replacement + training + lost production: 49,650 €**

## Accounting for health and illness

### Salary costs

Different countries have different ways of allocating illness costs, e.g. what costs are born by the individual or the employer, and what costs are born by government or collective insurance. An employer's total salary cost depends on national frameworks. As guidance, common cost items which might add up to your total salary cost, are presented in the table below.

Table 1: Example of how to calculate salary costs			
Direct and indirect salary costs		Example of company costs, €	Your calculus
Nominal salary	hour	17.00	
Fringe benefits (holidays, etc)	13%	2.20	
Other charges (taxes, insurance, retirement)	40%	6.80	
Administration overhead	24%	4.00	
<b>Gross total salary cost</b>	<b>hour</b>	<b>30.00</b>	
	<b>day</b>	<b>240.00</b>	

### Production value and profit contribution

To estimate the economic value of the production gained in the examples on good health, deductions need to be made for increased costs for supplementary fuel use and maintenance needs. On the other hand a machine stand still involves all costs *except* fuel and maintenance.

Production value = the price paid for the harvesting (or forwarding) service. The profit contribution equals the production value less variable costs.

This production value is then used to pay for four different items; gross total salary costs, capital costs, variable costs and profit margin, as shown below.

Table 2. Example of how to calculate profit contribution				
	Description	%	Example, €/hour	Your calculus
Production value	Paid price for service		100 €	
Gross total salary cost	From table 1	30-35%	30 €	
Capital costs	Depreciation, mortgage and interest on investment	30%	30 €	
Variable costs	Tires, oil, fuel, maintenance	30%	30 €	
Profit margin		5-10%	10 €	
<b>Profit contribution</b>	<b>Production value – variable costs</b>		<b>70 €</b>	

The proportion of the cost categories may vary substantially, primarily due to the age of your machine. E.g. a new harvester will have a better performance and a higher capital cost, but lower variable costs.

### Economic benefits of good health examples

Enter the calculated values on production gained and assign the profit contribution calculated in table 2.

Table 3. Example of how to calculate benefits of good health				
Increased productive hours by:	Hours /year	Formula hours * (profit contribution)		Your calculus
Increased gross machine availability	7.5	$7.5 * 70$	525 €	
Increased net machine availability	100	$100 * 70$	7,000 €	
Increased operator performance	160	$160 * 70$	11,200 €	

## Costs due to work related ill health examples

In this section the total costs for the work related illness in the four scenarios described earlier will be calculated as examples. The examples use a profit contribution of 70 €/h and 37.5 hours machine time per week for the operators. Sick pay has not been exemplified, due to large national variations.

### A. The operator continues working whilst ill

The operator experiences substantial pain in his neck for two weeks, but continues working whilst ill. The pain leads to reduced mobility and awareness, resulting in a need to take more breaks. In this case the cost will be confined to the operator's deteriorating health and reduced performance. If we consider a 20% reduction in performance this translates to:

- Enter the number of days and productive hours and the percentage reduced performance you think will apply, and then use the value for profit contribution which you have calculated above.

Table 4. Sick on the job			
	Description/formula	Example	Your calculus
Profit contribution/h	Production value – variable costs	70 €	
Production loss/h	20% reduced performance	14 €	
<b>Total cost for 2 weeks reduced production</b>	<b>2 (7.5 * 5) = 75 hours ⇒ 75h * 14 €</b>	<b>1,050 €</b>	

### B. The operator is ill and absent for two weeks, but there is a replacement available

The operator is replaced with an in-company operator. The additional salary costs 20 % (6 €). The performance of the substitute operator is 10% less than the ill operator's performance.

- Enter the length of the illness, the increased salary cost and whether you consider that there will be a reduction in performance.

Table 5. Sick with replacement			
	Description/formula	Example	Your calculus
Increased salary costs	2 (7.5 * 5) = 75 hours * 6	450 €	
Production loss	- 10% performance (0.1 * 70€ * 75h)	525 €	
Sick pay + other replacement costs	Difficult to generalise	-	
<b>Total cost for 2 weeks reduced production</b>	<b>450€ + 525€</b>	<b>975 €</b>	

### C. The operator is absent due to illness for one week and there is no replacement

In this case the machine will stand still during the episode.

→ Enter number of hours and profit contribution, sick pay and other replacement costs.

Table 6. Illness without replacement			
	Description	Example	Your calculus
Production loss/hour	Production value – variable costs	$100 - 30 = 70\text{€}$	
Sick pay + other replacement costs	Difficult to generalise	-	
Daily cost for failed production	$7.5 * 70 \text{€}$	525 €	
<b>Total cost for 1 week's failed production</b>	<b><math>5 * 525 \text{€}</math></b>	<b>2,625 €</b>	

### D. The illness is long-lasting; there is a need for recruitment

If an operator develops a long-term illness there will probably be a number of illness episodes and costs similar to the ones quoted above for a long time, perhaps for years. The costs will add up, and the operator might become so ill that he cannot continue working. If you need new personnel additional costs include recruitment and training costs.

The recruitment cost is made up of advertising and operator selection and evaluation. Regarding the training cost, interviews indicate that newly qualified operators work at 50% effectiveness initially. It might take 6 months for a forwarder operator to reach 100% and 1 year for a harvester operator working in clear cuts and 1.5 years for a harvest operator working in thinning. The mean production loss is for forwarder operators 1.5 months' lost production value and for harvester operators almost 4 months.

We consider that recruitment, interviewing and selection take two weeks and the training time involves 4 months' lost production from the harvester.

Table 7. Long-term illness, need for new personnel			
	Description	Example	Your calculus
2 weeks' recruitment costs	10 days * 240 €/day	2,400 €	
90 days' lost production	$90 * 7.5 \text{ hours} * 70\text{€/h}$	47,250 €	
Severance pay, other replacement costs	Difficult to generalise	-	
<b>Total cost</b>		<b>49,650 €</b>	

## How much to invest and why

If you are considering some investment to prevent work related illness or accidents, the calculations on health and illness consequences can provide some guidance. The activity may concern new technology, health monitoring and improvement, work organisation, or training, it may cost 500 or 20,000 Euro.

1. The examples showed that increased net machine availability and operator performance due to good health might be worth 18,000 €/year (525 € + 7,000 € + 11,200 €).
  - How does this correspond to your experience?
2. In example A, evading a two week ill-at-work episode on a yearly basis is worth a yearly investment of 1,000 € or almost 5,000 € for a five-year period.
  - How does this correspond to your situation?
3. In example C, evading two days of machine standstill per year yields the same benefit, i.e. 1,000 €/year.
  - How does this correspond to your situation?
4. According to example D, diminishing the risk of personnel turn over, the saved cost of recruitment and training is on the order of 50,000 €.
  - What is your estimation?

You invest to improve working conditions, to evade some of the costs listed above. The outcome of the investment is frequently uncertain; it may fall short of or surpass expectations. An exact calculation is therefore not possible. What is suggested here is that you agree upon an investment and then use the costs and benefits that you have calculated before to get a rough idea of how well the investment is funded. This also gives you a way to follow up on the investment at a later stage.

Character of investment		Total investment cost, €	

For the investment to be profitable the following benefits must be achieved:

Benefit	No.		Euro, €
Increased productive hours		at a value of	
Evaded ill-at-work episodes		at a value of	
Evaded sick days		at a value of	
Evaded hours of production stops		at a value of	
Other benefits		at a value of	
<b>Total benefits to match investment cost</b>			

## 6. Protocol for assignment of responsibilities

<b>Company / team</b>	
<b>Responsible person</b>	

### Safety check every three months

	Date	Sign	Date	Sign	Date	Sign	Date	Sign
Gas container								
Medical kit								
Oil store cleanliness								
Chain saw								

### Team member responsibilities

Area	Name of responsible person
Harvester	
Forwarder/Skidder	
Fuel	
Chain saws	
Tools	
Safety and health information	
Spare parts	
Signs and gates	
Personal protective equipment	
Personnel caravan	
Contacts with electricity company (lines)	
Information (public, schools etc)	
Telephones, communication	

## 7. Template for documentation of an activity

<b>We have agreed on this activity:</b>		
<b>We carry out the activity because we want to reach the:</b>		
- key indicators on improvement	1	
	2	
	3	
	4	
<b>Involved persons</b>	<b>Names</b>	<b>Responsible (x)</b>
- contractor		
- supervisor		
- operators		
<b>Time schedule</b>		
- start at		
- finish at		
- follow up at		
<b>Budget</b>		
<b>Follow up</b>		

## 8. Introduction of tool: European ergonomic checklist for forest machines

The European Ergonomic Checklist for Forest Machines is for checking if a machine fulfils ergonomic and safety requirements. You can use it as a safety inspection of your machine, or before buying a new one. This checklist is a simplified edition of the more comprehensive 'European Ergonomic and Safety Guidelines for Forest Machines', which is mainly for use by the machine manufacturers.

### How to use the checklist

The ergonomic checklist leads you step by step through the most relevant ergonomic and safety features of the machine. In order to gain an overview it is appropriate to compile an ergonomic and safety profile of the machine.

Ergonomic and safety profile			
	Number of marks		
Feature	Green	Yellow	Red
Cab access	Green	Yellow	Red
Cab	Green	Yellow	Red
Visibility	Green	Yellow	Red
Operator's seat	Green	Yellow	Red
Controls	Green	Yellow	Red
Operating the machine	Green	Yellow	Red
Working posture	Green	Yellow	Red
Winch	Green	Yellow	Red
Noise	Green	Yellow	Red
Vibration	Green	Yellow	Red
Cab climate	Green	Yellow	Red
Lighting	Green	Yellow	Red
Instructions and training	Green	Yellow	Red
Maintenance	Green	Yellow	Red

Apart from familiarity with the machine operations, the only things you need are pen, paper and a measuring tape.

Each feature consists of detailed questions about the ergonomic and safety status.

You assess if the detail asked for in the checklist is in the green, yellow or red zone.

Green is OK.

Yellow is action within some time.

Red is action directly, before further use.

Of highest importance for the operators health is how a machine meets the recommendations in the sections on operating the machine, working posture and vibration.

### Where to get the checklist

The European ergonomic checklist for forest machines can be downloaded from:

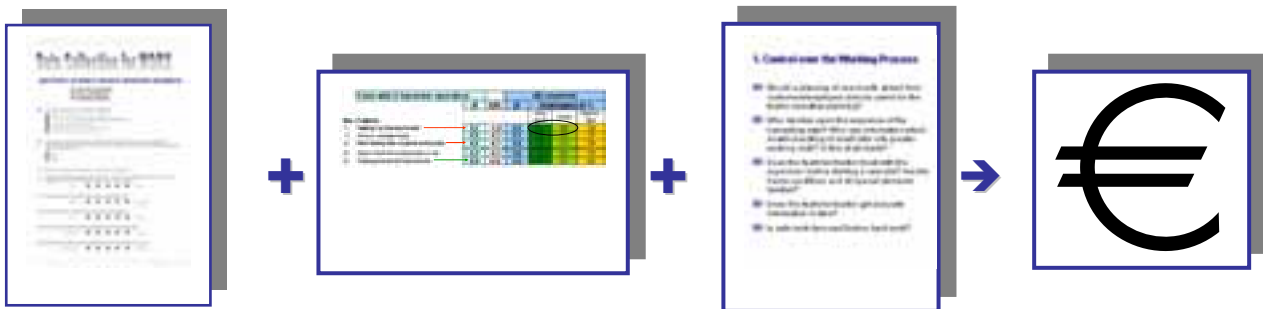
[www2.spm.slu.se/ergowood](http://www2.spm.slu.se/ergowood)

You can also find there the more comprehensive "European ergonomic and safety guidelines for forest machines".

## 9. Introduction of tool: WORX – make strengths and weaknesses in your work conditions visible

With WORX you can assess the working conditions in forest operations for mechanised teams and contractor firms.

The tool includes elements of benchmarking. Based on European comparisons, relevant improvement measures can be identified, discussed and prioritised.



### How to use WORX

You assess your current standards with regard to co-operation, mental strain, and the health situation of the operators with a questionnaire. Furthermore the questionnaire comprises your basic conditions, summarised as operator factors, work organisation and management system/support. Finally the working climate in your team is assessed in terms of the operators' control over the working process, their social support, how the operators identify themselves with the company, and their perceived possibilities to contribute to the improvements of the working practices.

With help of automatic routines the results are generated and presented graphically for each aspect, in total nine tables. WORX facilitates for single teams to compare themselves with data from six European countries; France, Germany, Norway, Poland, Sweden and United Kingdom.

Assistance and support in interpreting the results from the benchmarking with the WORX tool is provided as sets of motivating and provocative questions. Furthermore there is guidance on how to develop an action plan for improving work organisation in mechanised harvesting.

### Where to get WORX

The background and the detailed description of the tool are presented in Lidén, E., Benchmarks for a good work organisation and successful implementation processes, Report nr 24, Department of Forest Management and Products, Swedish University of Agricultural Sciences. The report and the tool itself can be downloaded from:

[www2.spm.slu.se/ergowood](http://www2.spm.slu.se/ergowood)

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<b>Contact person:</b>	Sten Gellerstedt, Department of forest products and markets, Swedish University of Agricultural Sciences, Uppsala, Sweden.	

Publisher, responsible under Swedish law:

Mats Nylinder, Department of forest products and markets, Swedish University of Agricultural Sciences,  
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Albert-Ludwigs-University Freiburg, Germany



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Forest Research Agency, Forestry Commission, UK



Kuratorium für Waldarbeit und Forsttechnik e.V., Germany



National Institute for Working Life West, Sweden



Norwegian Forest Research Institute



Qualifizierungsfonds Forstwirtschaft e.V., Germany



Warsaw Agricultural University, Poland

## Quality assurance:



FAO, Italy



National Institute of Occupational Health, Norway



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## Health and Performance in Mechanised Forest Operations

This handbook provides guidance on how to manage and improve the operators' health, safety and performance. It is aimed at work-teams, contractors and 1<sup>st</sup> line managers in mechanised forest operations

The first part of the handbook describes five steps for improvement to be taken by the employer and the team. Each step is supported by ideas, examples and questions. The second part presents nine tools for finding solutions. Examples of tools are:

- Assessment of work organisation
- Costs of illness and preventive measures
- Ergonomic checklist for forest machines.

The handbook is based on research and established practices of people using forest machines. Machine operators, machine owners, trade unions, contractor associations and forest companies, as well as health and safety authorities and researchers in six European countries contributed with their experience.

The handbook is a result from the project ErgoWood (2002 – 2005). The European Commission and the partners funded the project.

