

# GEOMETRIC THINNING FOR FOREST BIOENERGY

**Tomas Nordfjell**

**Dan Bergström , Rikard Wennberg, Julia Forsberg & Urban Bergsten**

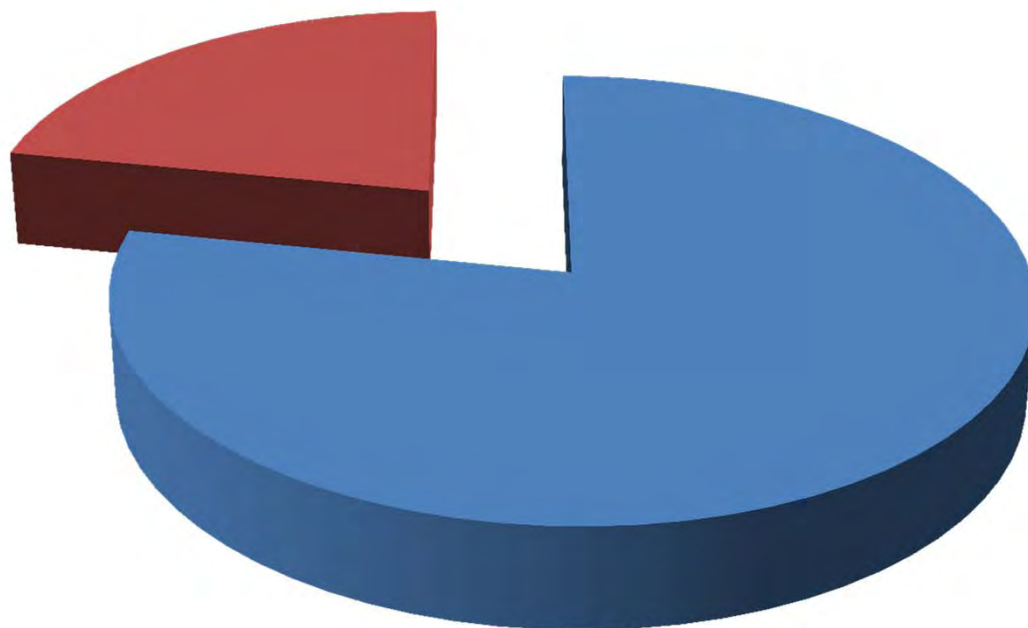


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**Tomas Nordfjell**  
Professor in Forest Operational Efficiency



**22% of the volume in Swedish forests is located in stands dominated by trees up to 14 cm diameter at breast height**

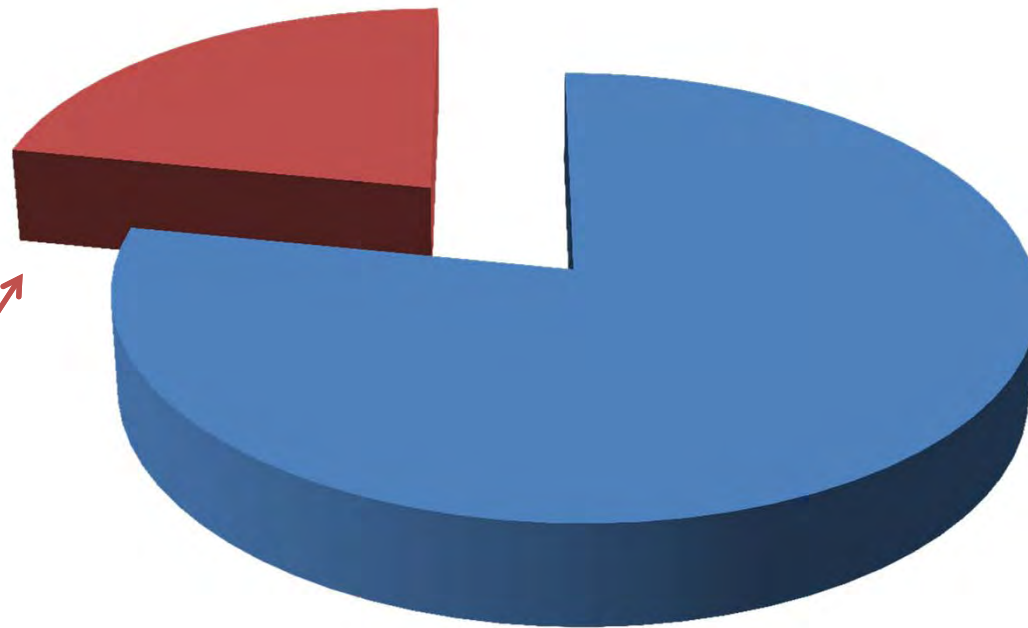


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22% of the volume in Swedish forests is located in stands dominated by trees up to 14 cm diameter at breast height



The total volume in those stands amount to **748 million m<sup>3</sup> solid**, and in many stands it is an urgent need of thinning

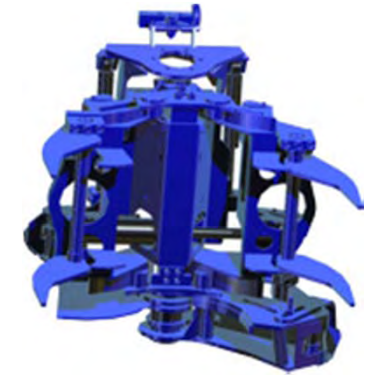


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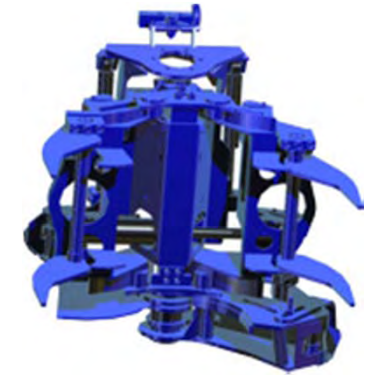




A large number of harvester/felling heads for multi-tree thinning of small diameter, dense stands have been studied during the last 5-10 years







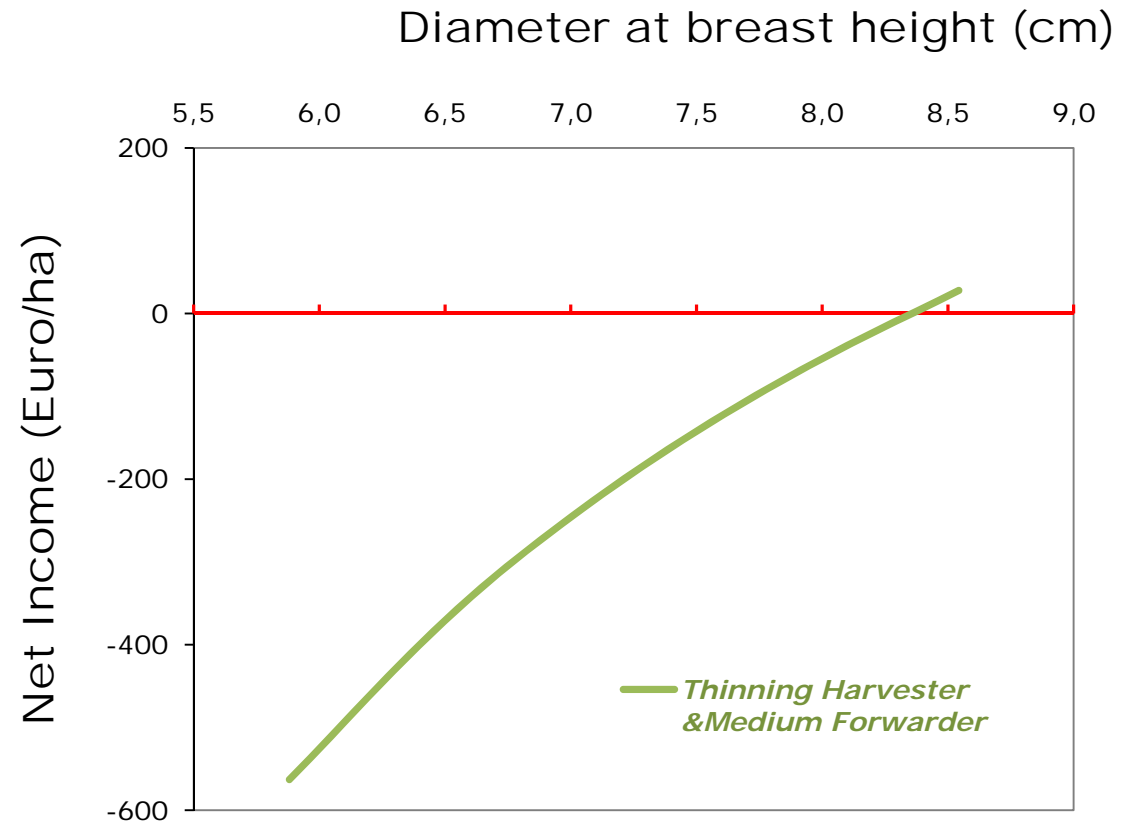
The product from such thinnings is undelimited trees, or tree-parts for energy use



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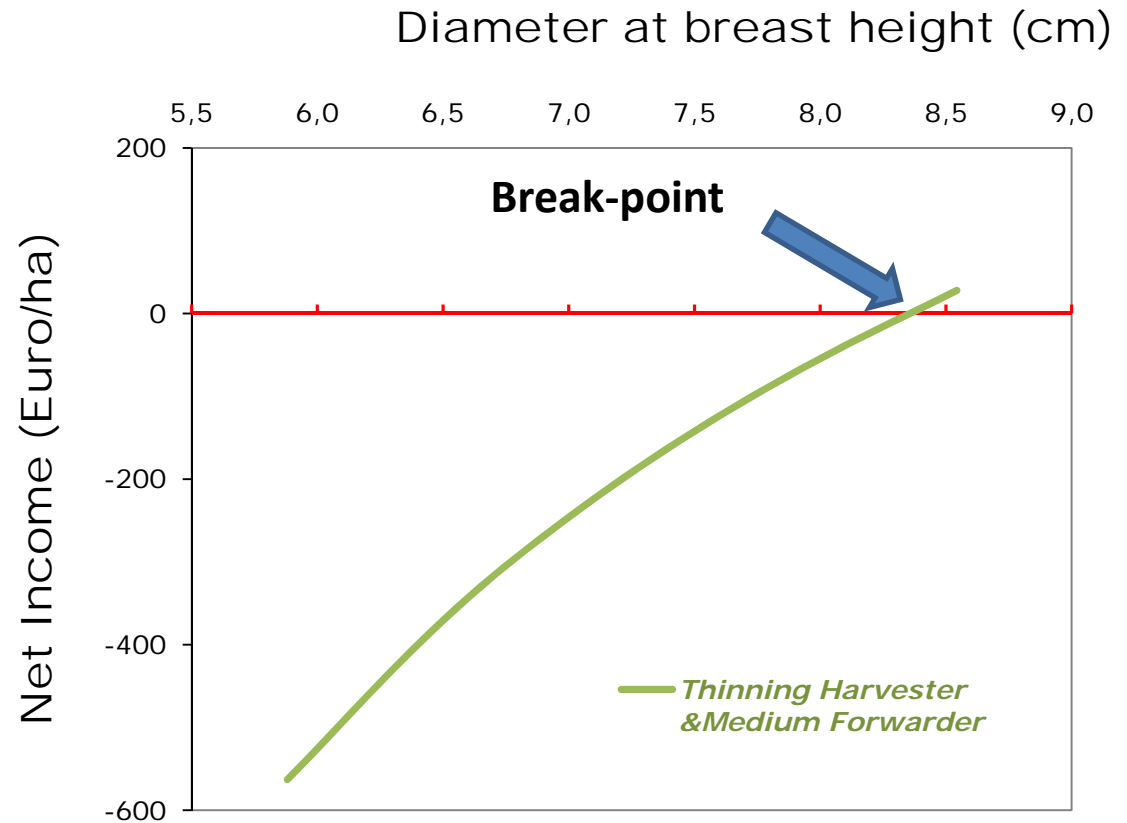
However, all results show that even when accumulating several trees, economical production can **not** be achieved when thinning of stands with diameters below 8-9 cm at breast height



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Our conclusion is:  
To get economy in thinning  
of young dense stands, a  
geometric approach has to  
be used were **MANY**  
trees are harvested in a  
single boom movement



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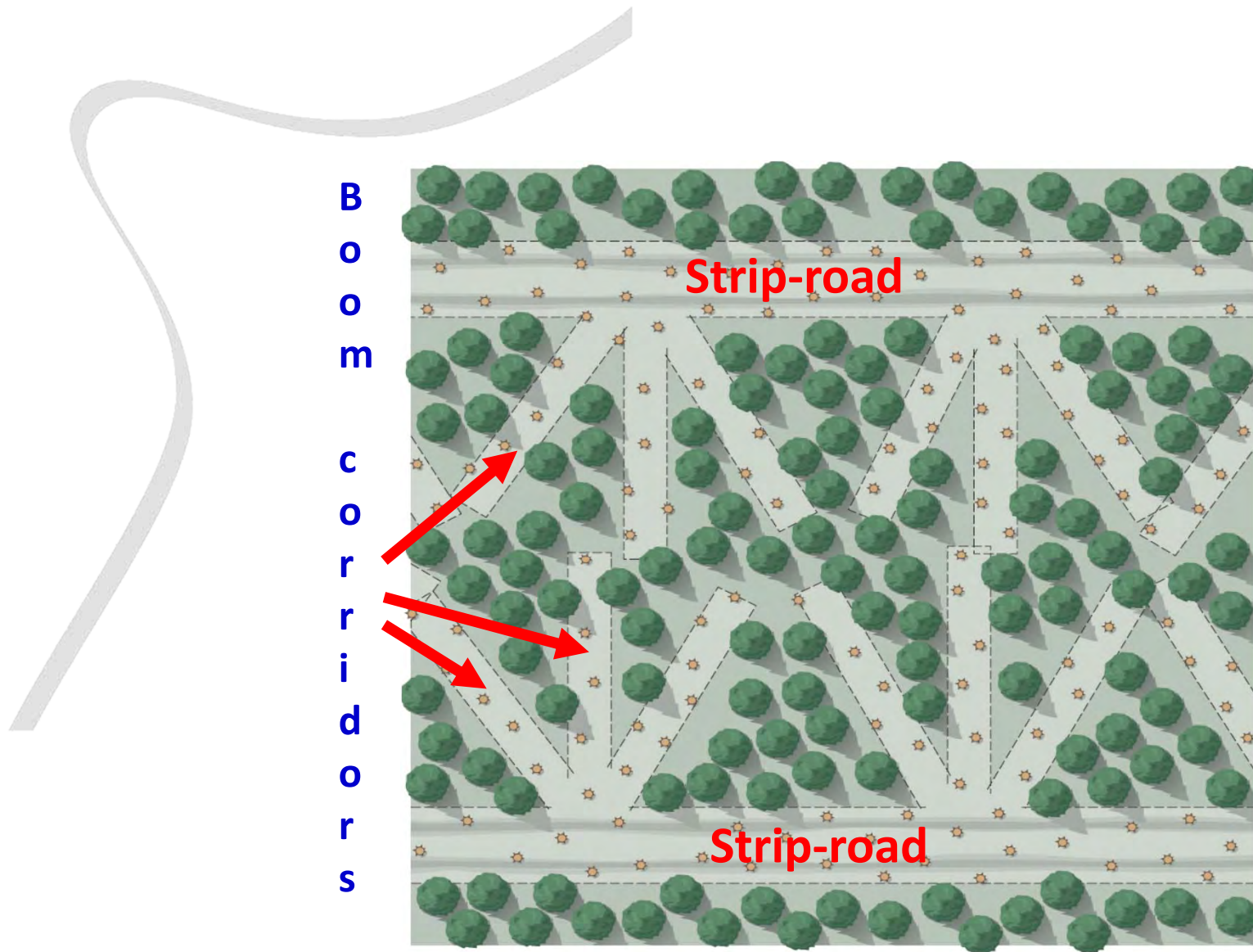




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**(An experimental rig,  
from a previous  
Phd project)**





(Drawing: Per Thorneus, "Skogen" forest magazine no. 11-2006)







**The aim has been to take the promising results from the Phd thesis of Dan Bergström to a higher level of application**



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This is the result from a mechanical engineering Master thesis study about designing a concept on a felling and bunching head for Boom-corridor thinning of young dense stands

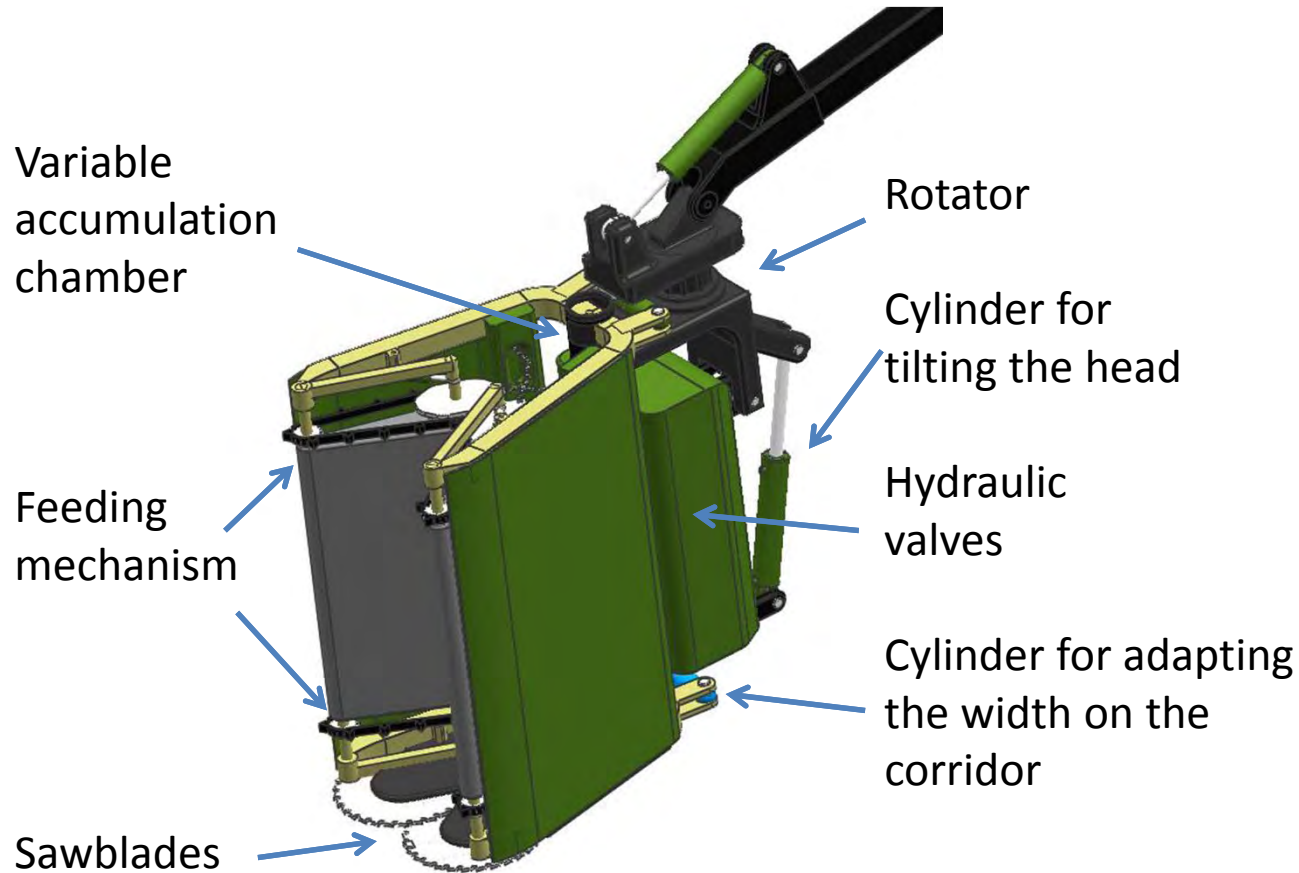


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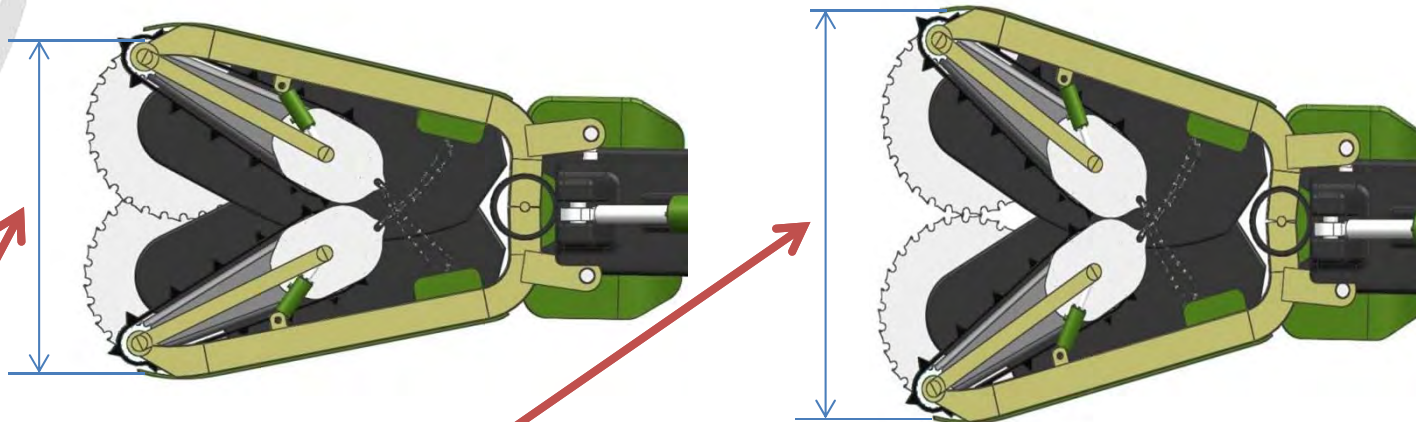
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Adapting the width on the corridor



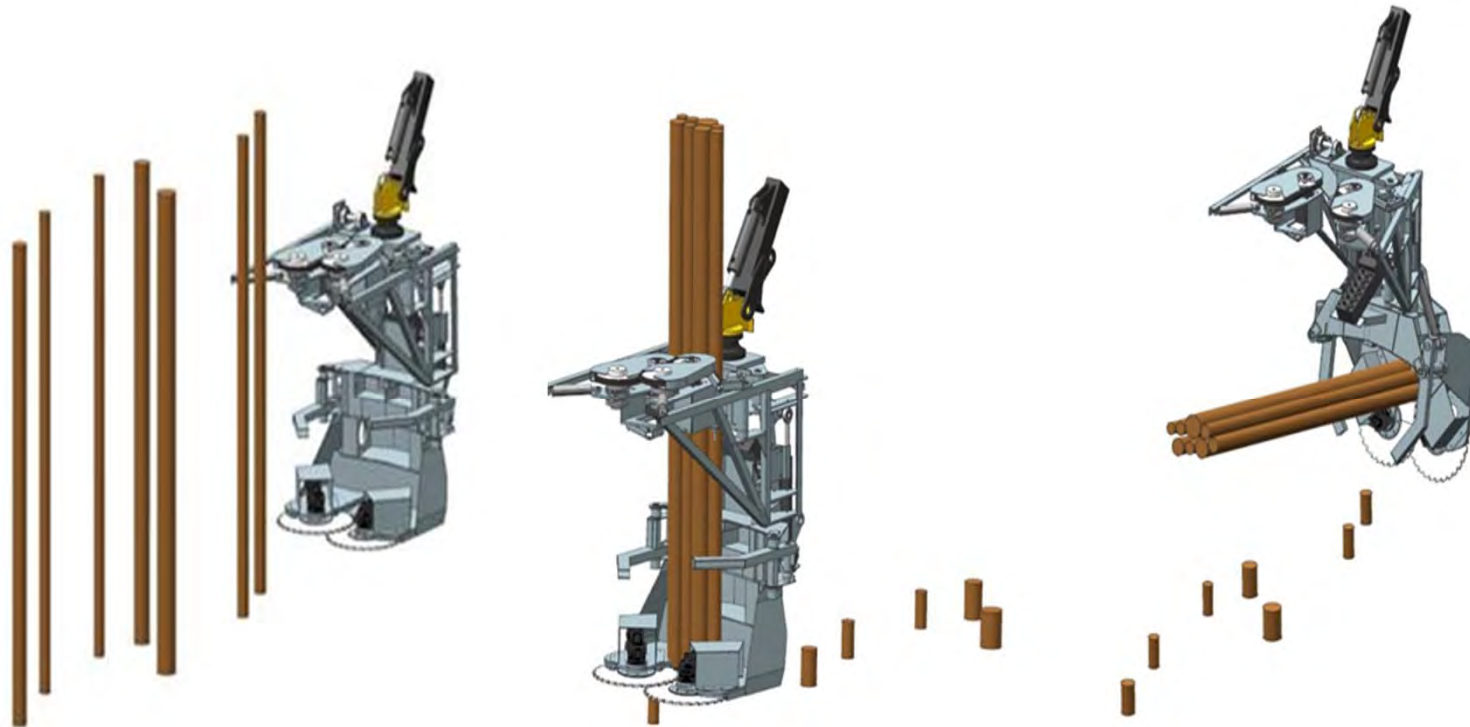
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Building a **prototype** on a felling and bunching head for Boom-corridor thinning of young dense stands

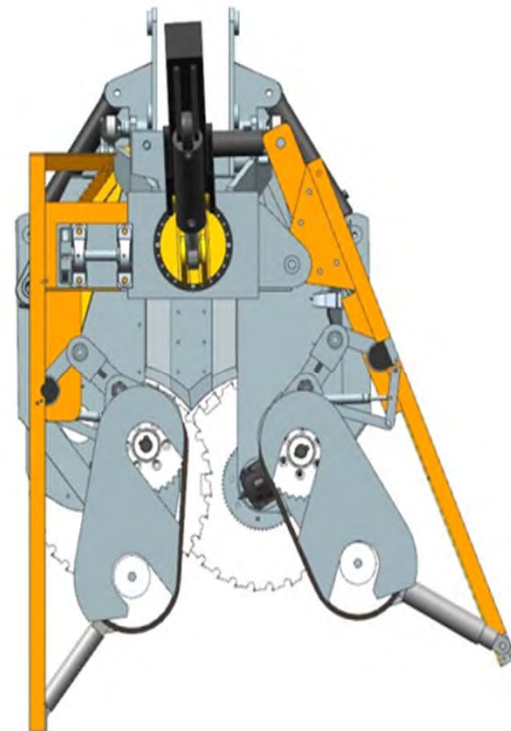
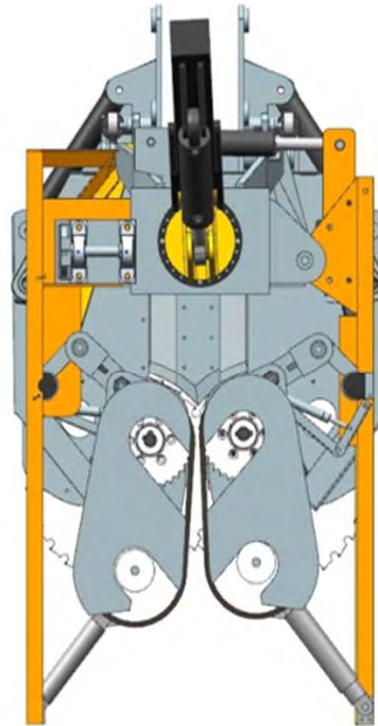
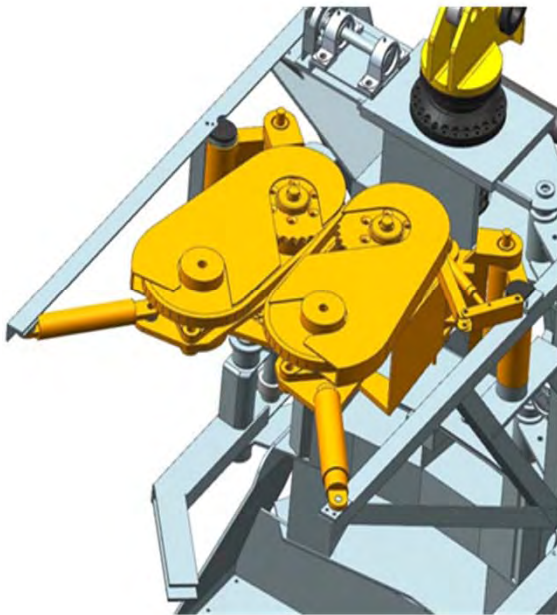


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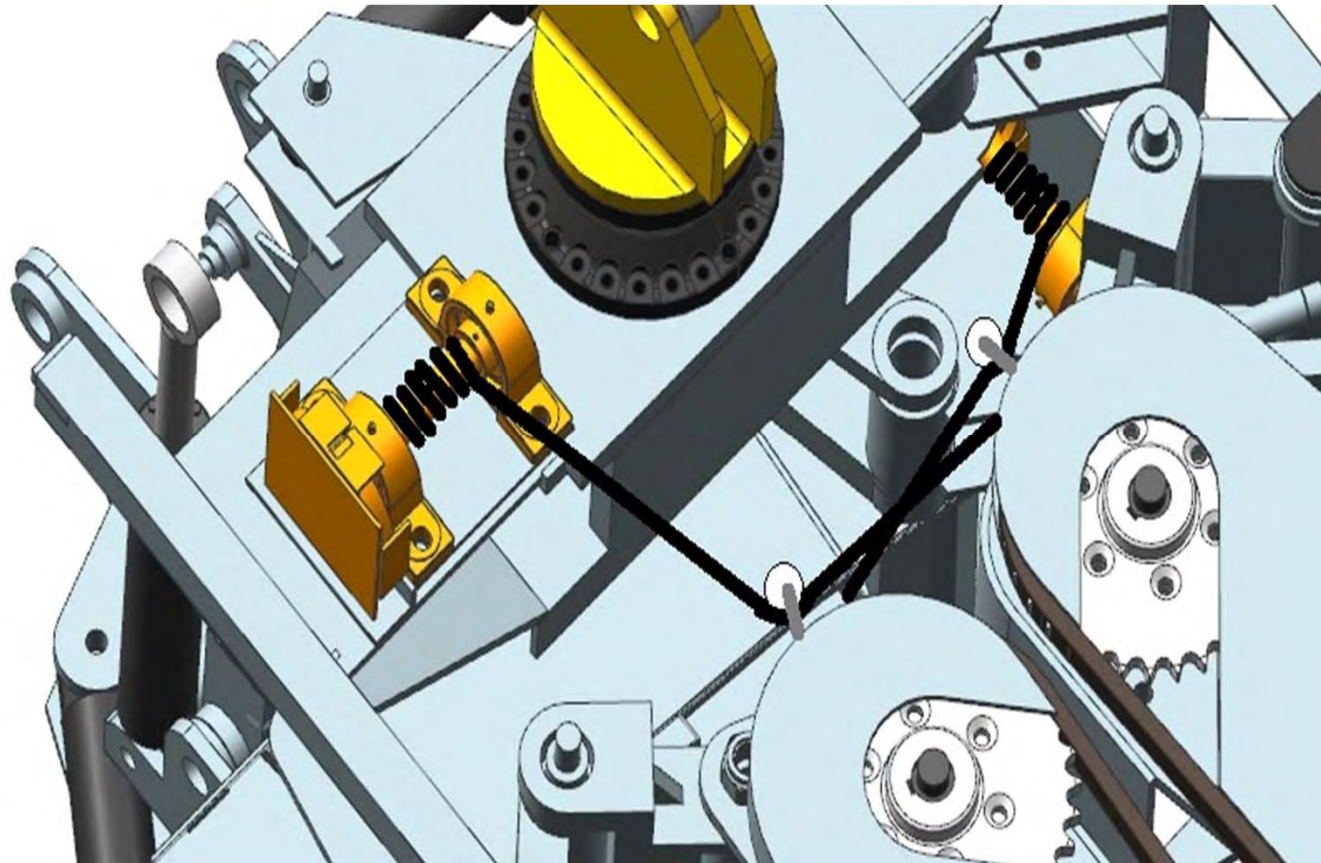
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Building a **prototype** on a felling and bunching head for  
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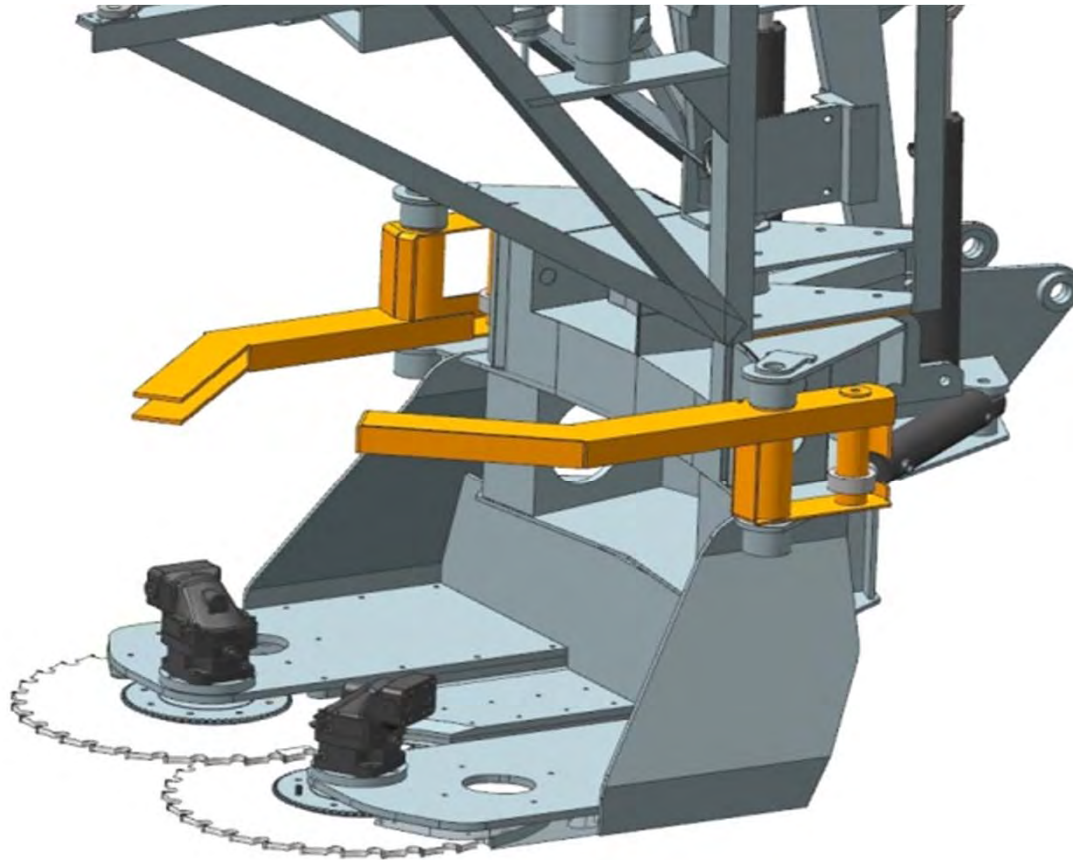
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Building a **prototype** on a felling and bunching head for Boom-corridor thinning of young dense stands



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The real **prototype** on a felling and bunching head for Boom-corridor thinning of young dense stands



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The real **prototype** on a felling and bunching head for Boom-corridor thinning of young dense stands



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**So far, only an initial evaluation has been made. However, it could be verified that all individual functions (i.e. felling, feeding, accumulation and handling) worked, and that the accumulation capacity was sufficient for handling all trees in most boom corridors.**

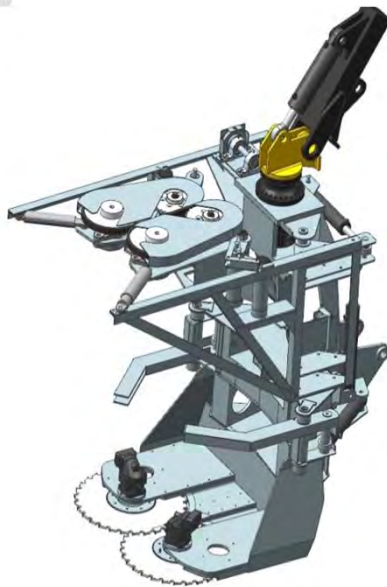


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**The vast majority of researchers, forest company staff and machine manufacturers at an excursion concluded that the first important steps on a new harvesting technique for bioenergy thinning of young dense stands had now been taken !**



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**The End**



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