



UNIVERSITÀ
DEGLI STUDI
FIRENZE
DAGRI
DEPARTMENT OF
AGRICULTURE, FOOD
ENVIRONMENT AND FORESTRY



55th International Symposium on Forestry Mechanization (FORMEC) 7th Forest Engineering Conference (FEC)



Improving access to sustainable forest materials in a resource-constrained world



Conference programme

September 20 - 22, 2023 Firenze, Italy





Organizers

University of Florence - DAGRI



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The University of Florence is an Italian research and education institution, with over 1,700 professors and researchers, more than 1,600 technical-administrative staff members, and over 55,000 students. The Department of Agricultural, Food, Environmental, and Forestry Sciences (DAGRI) is committed to developing knowledge and skills for sustainable development based on biological natural resources, focusing on the sustainable management of agricultural, animal, and forestry resources through integrated and multidisciplinary approaches. The aim is to preserve and enhance environmental quality and vital components such as soil, microorganisms, plants, animals, and biodiversity.

Tuscany Region

The Tuscany Region dedicates a specific branch to forestry, agro-environment, water resources and climate change mitigation, for setting the political and technical principles for the development of these sectors in Tuscany.

The branch promotes sustainable forest management and forest certification (PEFC and FSC member), as well as forest operator training at the Rincine Training Centre. It also promotes forest planning at all levels and the active management of forest stands, both public and private, by means of regulatory and technical actions. The regional agricultural forestry property is made up of more than 110,000 hectares of wooded land distributed over all Tuscany. Since 2019 the Tuscany Region oversees the management of the Mediterranean model forest network (<https://www.medmodelforest.net/en/>).

It has exclusive competence in forest fire control, with a focus on prediction, prevention, and active firefighting. Its effective response system, backed by a tradition of specialized training for operational staff at the Regional Center "La Pineta", ensures effective and concentrated efforts. This capacity places Tuscany at the forefront among Italian regions.

REGIONE
TOSCANA



Italian Academy of Forest Sciences

The Italian Academy of Forest Sciences (AISF) is a non-profit organization dedicated to promoting and disseminating research, education, and conservation of forest resources in Italy. Established in 1951, the Academy serves as a significant reference point for scientists, researchers, and experts in the field of forest sciences.

The Academy organizes conferences, seminars, training courses, and produces scientific publications to share the latest discoveries and information in the field of forest sciences.



ACCADEMIA ITALIANA DI
SCIENZE FORESTALI

Nation Research Council - IBE

The National Research Council (CNR) is the main scientific research agency of the Italian Government: it manages 88 Institutes and employs 8500 researchers, technicians and administrative officers. Founded in 1923, it is an independent public organization conducting research in all fields of science. CNR promotes innovation, technological development, and international collaboration.

The Institute for Bioeconomy (IBE) focuses on the development of innovative strategies for the sustainable management of natural resources, the enhancement of biological products, and the promotion of innovative solutions in the fields of agriculture, energy, and the environment.



Consiglio Nazionale
delle Ricerche

Istituto per la BioEconomia

Partners

Italian Society of Silviculture and Forest Ecology



Italian Union for Scientific Innovation in Forestry



International Union of Forest Research Organizations



Associazione Universitaria Studenti Forestali - Firenze



Austria's Forest Machine Demonstration



University of Natural Resources and Life Sciences, Vienna



Organizing Committee

Enrico Marchi	University of Florence, Italy
Raffaele Spinelli	Italian National Research Council - IBE, Italy
Karl Stampfer	BOKU Institute of Forest Engineering, Austria
Nataschia Magagnotti	Italian National Research Council - IBE, Italy
Elena Marra	University of Florence, Italy
Benno Eberhard	Italian National Research Council - IBE, Italy
Raffaele Cavalli	University of Padova, Italy
Cristiano Foderi	University of Florence, Italy
Elisabetta Gravano	Tuscany Regional Administration, Italy
Stefano Grigolato	University of Padova, Italy
Christian Kanzian	BOKU Institute of Forest Engineering, Austria
Andrea Laschi	University of Palermo, Italy
Rodolfo Picchio	University of Tuscia, Italy
Sandro Pieroni	Tuscany Regional Administration, Italy
Rosario Andrea Proto	Mediterranean University of Reggio Calabria, Italy
Antonio Ventre	Tuscany Regional Administration, Italy

Scientific Committee

Chairs

Enrico Marchi	University of Florence, Italy
Raffaele Spinelli	Italian National Research Council - IBE, Italy
Rien Visser	Canterbury University, New Zealand
Karl Stampfer	BOKU Institute of Forest Engineering, Austria

Members

Kazuhiro Aruga	Utsunomiya University, Japan
Ebru Bilici	Giresun University, Turkey
Mark Brown	University of the Sunshine Coast, Australia
Woodam Chung	Oregon State University, USA
Jean-Francois Gingras	FP Innovations, Canada
Saulo Guerra	University of San Paolo, Brazil
Eric Labelle	University of Laval, Canada
Luc Lebel	University of Laval, Canada
Natascia Magagnotti	Italian National Research Council - IBE, Italy
Tomas Nordfjell	Swedish University, Sweden
Muedanyi Ramantswana	Nelson Mandela University, South Africa
Dominik Roeser	University of British Columbia
Janine Schweier	Swiss Federal Research Institute, Switzerland
Rolf Bjorheden	Skogforsk, Sweden
Jori Uusitalo	University of Helsinki, Finland
Dirk Jäger	University of Göttingen, Germany
Andreas Holzinger	University of Vienna, Austria
Francesco Neri	University of Florence, Italy
Dalia Abbas	University of Minnesota, USA

Location of the venue

Santa Apollonia Auditorium and Poccetti room

Address: Via San Gallo 25, Florence

How to get there:

Bus Lines: 1, 6, 7, 11, 14, 17, 20, 23, 31, 32, 52 (Stop: Santa Riparata) + 1 minute walk (average time 8-11 minutes)

On foot from Santa Maria Novella Station: 12 minutes (1.0 km)

By Tram from Florence Airport: TRAM T2 towards Unità, Stop: Rosselli (travel time 25 minutes)

Taxi: Phone number 055 4390/4242, average cost €23-€28 (Stop: Santa Maria Novella Station), travel time 9 minutes (8.6 km)



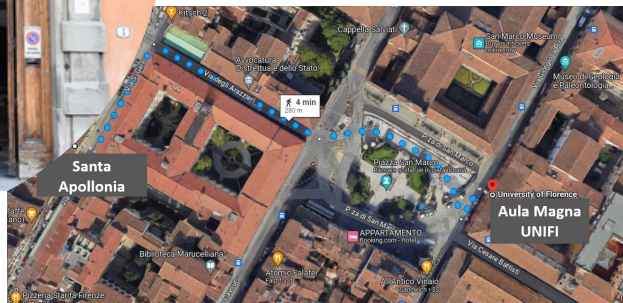
Aula Magna UNIFI

Address: Piazza di San Marco, 4, 50121 Florence

How to get there:

From Santa Apollonia Auditorium, 4 min on foot (300 m):

- Exit in Via San Gallo 25 and turn left towards Via degli Arazzieri.
- Turn right onto Via degli Arazzieri and continue straight towards Piazza di San Marco.



Location of the venue

Aula Magna Umaform

Address: Via Laura, 48, 50121
Florence

How to get there:
From Santa Apollonia
Auditorium, 8 min
on foot (650 m)

- Exit in Via San Gallo 25 and turn left towards Via degli Arazzieri.
- Turn right onto Via degli Arazzieri and continue straight towards Piazza di San Marco.
- Cross the square and take Via Cesare Battisti.
- Continue onto P.za della SS. Annunziata.
- Turn left onto Via Gino Capponi.
- Turn right onto Via Laura.



Conference map



General programme

Time	19 th Sept	20 th Sept	21 st Sept			
			Santa Apollonia - Auditorium	Aula Magna - UNIFI	Santa Apollonia - Poccetti room	Aula Magna - Umaform
08:00			Registration			
08:30			Plenary session			
			<i>Welcome remarks</i>			
			<i>Keynote speakers</i>			
			<i>Women panel</i>			
10:30		Field Trip	Coffee Break			
11:00			Technical sessions			
11:10			<i>Logging residue quantification, distribution and management</i>	<i>Stand characterization and inventory</i>	<i>Safety</i>	<i>Harvesting methods</i>
12:40		Participants will be picked up in Florence by charter buses and taken to Pistoia and its surroundings	Lunch			
13:40			Technical sessions			
13:50			<i>Value chain management</i>	<i>The future of training and teaching - Special TD Session</i>	<i>Ergonomics</i>	<i>Fuel use monitoring and management</i>
15:20			Coffee Break			
15:50			Technical sessions			
16:00			<i>Analysis and use of harvesting machine systems and data</i>	<i>Innovation to improve forest operations of the future</i>	<i>Forest Operations management</i>	<i>Silviculture and wildfire management</i>
19:00	Icebreaker Event Registration					
19:30	Le Murate Caffè Letterario Address: Piazza delle Murate 50122 Firenze FI		Social dinner Terrazze Michelangelo (address: Viale Michelangiolo, 61, 50125 Firenze)			

General programme

Time	22 nd Sept				23 rd Sept
	Santa Apollonia - Auditorium	Aula Magna - UNIFI	Santa Apollonia - Poccetti room	Aula Magna - Umaform	
09:00	Technical sessions				Post-Conference tour to AUSTROFOMA (details on p.27)
	<i>Wood quality assessment, bucking optimization, and biomass estimation from machine and Lidar data</i>	<i>Precision and automated tree planting</i>	<i>Digitalization</i>	<i>Electrification</i>	
10:30	Coffee Break				
11:00	Coffee Break				
11:10	Technical sessions				
	<i>Determining soil impacts</i>	<i>Automatic wood tracking and loading operation</i>	<i>Forest Roads</i>	<i>Steep Terrain - Yarders and helicopters</i>	
12:40	Lunch				
13:40	Lunch				
13:50	Technical sessions				
	<i>Mitigating soil impacts</i>	<i>Enterprise, business and workforce</i>	<i>Transport logistics and technology</i>	<i>Steep Terrain - Winch-assist</i>	
15:20	Coffee Break				
15:50	Coffee Break				
16:00	Closing ceremony - Next meetings, announcements, conclusions				
17:30					

Session Details - Thursday 21st

08:30 - 10:30

Santa Apollonia
Auditorium

Plenary session:
Welcome remarks

*Tuscany region
University of Florence - DAGRI
National Research Council - IBE*

Keynote speakers

*Prof. em. Dr. Hans Rudolf Heinemann and Prof. Dr.
Gerald Steinbauer-Wagner*

Women panel

Moderator: N. Magagnotti

10:30 - 11:00

Coffee break

11:10 - 12:40

Technical sessions:

Santa Apollonia Auditorium Logging residue quantification, distribution and management
Moderator: F. Latterini

Estimating the non-utilized merchantable volume of coniferous trees with the use of harvester data

Myriam Delmaire, Eric R. Labelle

The quantification of *Pinus patula* recovery and productivity of manually orientated biomass collection in post mechanised full tree and semi mechanised tree length harvesting operations

Thandekile Ncongwane, Muedanyi Ramantswana, Raffaele Spinelli, Andrew McEwan

Characterization and spatial distribution of logging residues as indicators for the successful of natural and assisted forest regeneration

Alberto Udali, Gunta Grube, Sara Cucchiaro, Emanuele Lingua, Stefano Grigolato

Development of a photogrammetry-based method to estimate the gross volume of energy wood stacks

Felipe de Miguel-Díaz, Benjamin Engler, Thomas Purfürst

The burning question: addressing harvest residue management in British Columbia

Eric Nance, Dominik Roeser

Mapping root rot with harvester data

Simon Berg

Session Details - Thursday 21st

Aula Magna
UNIFI

Stand characterization and inventory

Moderator: *H. U. Sauter*

Seeing the trees despite the forest: Lidar-based vision support system for harvester operators

Back Tomas Ersson, Dan Bergström, Håkan Lideskog

Comparison of eucalyptus stem diameter estimation from terrestrial laser scanning point cloud data and ground-based measurements

Laddawan Rianthakool, Jirawat Yingdee, Theerapong Chumsangsri, Detrit Sittibal

Identification, geolocation and accurate harvest of dying oak trees in climate change context

Emmanuel Cacot, Marie Bastien

Sensing technology and AI algorithms for detecting tree quality features and optimizing bucking during harvesting operations in Radiata pine plantations

Mauricio Acuna, Jan Rombouts, Covadonga Prendes

Challenges and opportunities for use of digital technologies for forest operations in Portugal

Alexandra Marques, José Luis Carvalho, Beatriz Lourenço, Francisco Manso, Carolina Catorze, Pedro Britto

Enhancing efficiency and value through full traceability of timber from the forest to the sawmill

Carolin Fischer, Mostafa Hoseini, Yobann Jacob Sandvik, Csongor Horvath, Rasmus Astrup

Santa Apollonia
Pocetti room

Safety

Moderator: *M. Mihelic*

Work efficiency and exposure to noise during tree felling with electric saw in real forest conditions

Anton Poje, Luka Pajek, Benjamin Lipužič

Session Details - Thursday 21st

How actionable explainable AI (AxAI) can contribute to a better understanding of forest accidents

Anna Saranti, Arne Gevaert, Ferdinand Hönigsberger, Alessa Angerschmid, Anabid Jalali, Christoph Gollob, Carl Orge Retzlaff, Florian Sommer, Karl Stampfer, Andreas Holzinger

Using UWB sensors to monitor the danger zone of timber harvesting operations

Ferdinand Hönigsberger, Christoph Gollob, Erwin Stampfer, Andreas Holzinger, Karl Stampfer

Forestry personal protective equipment and its influence onto psychophysical load

Luka Pajek, Matevž Mibelič, Anton Poje

Characterization of Swedish forestry contractors' practices regarding occupational safety and health

Thomas Kronholm, Rikard Olsson, Carola Häggström

Development and evaluation of a felling head for a light forest crawler

Christian Knobloch, Joern Erler

Aula Magna
Umaform

Harvesting methods

Moderator: *J. Schweier*

Harvesting methods information tool

Frauke Brieger, Udo Hans Dr. Sauter

Harvesting methods and operations of industrial roundwood in Western Europe

Kalle Kärhä, Niko Purmonen, Christian Kanzian, Nikolaus Nemestohy, Philippe Ruch, Andrea Hauck, Raffaele Spinelli, Natascia Magagnotti, Simon Berg, Eduardo Tolosana, Mikael Lundbäck

Criteria and Indicators for assessing the sustainability of timber harvesting operations — a systematic review

Julian Grünberg, Mohammad Reza Ghaffariyan, Meghdad Jourgholami, Eric R Labelle, Nopparat Kaakkurivaara, Renato Cesar Goncalves Robert, Martin Kühmaier

Session Details - Thursday 21st

Central European multi criteria decision support systems to enhance forest management under climate change

Janine Schweier, Stefan Holm, Leo G. Bont

Potential impacts of EU policy proposals on timber harvesting in Finland

Kari Väättäin, Perttu Anttila, Antti Mutanen, Anssi Abtikoski, Johanna Routa, Juba Laitila, Jari Lindblad, Matleena Kniivilä

Outcomes of applying a triad perspective for evaluating wood harvesting services

Emanuel Erlandsson, Dag Fjeld, Gun Lidestav, Ida Tjärnström

12:40 - 13:40

Lunch

13:50 - 15:20

Technical sessions:

Santa Apollonia
Auditorium

Value chain management

Moderator: *E. Labelle*

Machine learning-based forest biomass supply chain management for bioenergy

Jingban Zhao, Jingxin Wang

Does biomass harvest and utilisation for industrial purposes reduce GHG emissions beyond the forest landscape boundaries?

Dimitris Athanassiadis, Erik Anerud, Carmen Cristescu

The loss of high-value chemicals in the forest biomass supply chain

Hanna Brännström, Johanna Routa, Petri Kilpeläinen, Robert Prinz

How much does it cost to increase the procurement of logging residues in Sweden?

Raul Fernandez-Lacruz, Anders Eriksson, Thomas Parklund, Lars Eliasson, Aron Davidsson

Estimating slash pile burn occurrence in British Columbia using very high-resolution virtual globe imagery

Andrea Nesdoly, Zexi Liu, Ben Hudson, Dominik Roeser, Werner Kurz

Next generation solution for wood supply optimization.

Raimonds Šules, Andris Kampernovs

Session Details - Thursday 21st

Aula Magna The future of training and teaching - Special TD Session
UNIFI

Moderator: *J. Erler*

Technodiversity - International cooperation in teaching

Jörn Erler

Scientific audio-visuals for an enhanced learning experience of machine components, functions, operations and setups, in timber harvesting: a core ambition of the Technodiversity Project

Stelian Alexandru Borz

Technodiversity course accreditation

Piotr S. Mederski

Santa Apollonia
Pocchetti room

Ergonomics

Moderator: *C. Haggstrom*

Can motion capture suit help us understand the center of mass position? A case study of motor-manual work with a chainsaw

Matija Landekić, Marin Bačić, Zdravko Pandur, Marijan Šušnjar, Josipa Nakić, Mario Šporčić

A good night's sleep supports operational performance and workability - a longitudinal study with continuous data collection of CTL machine operators

Heli Kymäläinen, Jukka Malinen, Teppo Hujala, Carola Häggström

Exoskeletons in pruning operations - Results of a pilot study

Marius Kopetzky, Henrik Brokmeier, Dirk Jaeger

Measuring the workload of running forwarder vehicles focusing on machine movement

Chisa Nakata, Hirokazu Yamaguchi, Yuta Inomata

Brushcutter mounted debarker as small scale technology for in-stand debarking

Mehmet Eker, Raffaele Spinelli

Real-time mapping of workers and equipment in cable logging operations

Rob Keefe, Eloise G. Zimbelman

Session Details - Thursday 21st

Aula Magna
Umaform

Fuel use monitoring and management

Moderator: N. Magagnotti

Fuel consumption in final felling

Lars Eliasson, John Arlinger

Forwarding by farm tractors in low removal intensity, continuous cover forestry: a simulation of operational performance and fuel consumption

Gabriel Osei Forkuo, Mirella Elias, Stelian Alexandru Borz

Benefits of modelling fuel consumption and engine parameters of forestry machines through high-frequency data acquisition from CAN Bus system

Narcis Mihail Bacescu, Cadei Alberto, Iñigo Escamochero, Raffaele Cavalli, Stefano Grigolato

Search for harvester engine's optimal revolution per minute (RPM) to achieve high productivity and low diesel consumption

Piotr Mederski, Magdalena Gliwa, Przemysław Weltrowski, Andrzej Konieczny, Andrea Proto, Mariusz Bemberek

Autonomous truck vehicle and possibilities to reduce fuel consumption of transporting wood chips in mill yard of forest industry

Eetu Dahl, Abti Ullgren, Pekka Alajärvi, Kalle Kärhä

15:20 - 15:50

Coffee break

16:00 - 17:30

Technical sessions:

Santa Apollonia
Auditorium

Analysis and use of harvesting machine systems and data

Moderator: K. Kärhä

Final results of a survey on machine equipment and harvesting capacities of Austrian forest service companies and forest enterprises

Nikolaus Nemestothy, Christoph Huber, Jürgen Richter

Use and operation of the excavator in forestry

Federico Bertone, Marco Manzone

Session Details - Thursday 21st

Feller-Buncher production: validation of an integrated solution based on FPDat on-board computer systems and forest inventories

Steffen Lahrsen, Omar Mologni, Dominik Röser

A new method for harvesting hurricane damaged timber using a redesigned felling head for a rubber-tired feller-buncher

James Walker, Tom Gallagher, Timothy McDonald, Richard Cristan, Dana Mitchell

Country-wide analysis of the potential use of harwarders for final fellings in Sweden

Rikard Jonsson, Mikael Rönnqvist, Patrik Flisberg, Petrus Jönsson, Ola Lindroos

Is it possible to use the machine management data to estimate the effects of soil and terrain on the forest machine performance?

Filippo Guerra, Alberto Udali, Thilo Wagner, Francesco Marinello, Stefano Grigolato

Aula Magna Innovation to improve forest operations of the future
UNIFI

Moderator: **D. Röser**

Why robots are needed in forests?

Florian Sommer, Christoph Gollob, Arne Nothdurft, Karl Stampfer, Andreas Holzinger

Using machine learning approaches in the planning process of Quebec public forests to better harmonize environmental and economic goals

Abhut Parajuli, Luc LeBel, Alexander Morneau, Shuva Gautam

Assessing the feasibility of using super high-resolution forest environment maps in harvesting simulators for precision harvesting applications

Jori Uusitalo, Omid Abdi, Veli-Pekka Kivinen, Ville Laamanen, Janne Ruokonen

Harvesting fragmented forest: system selection using a simulation-optimization approach

Leo Painchaud, Luc LeBel, Daniel Beaudoin

Assisting harvester operator with real-time mobile laser scanning system in controlling harvesting quality in thinning stand

Johannes Pohjala, Ville Kankare, Juba Hyyppä, Kalle Kärhä

ForestSens: combining sensors and AI for sustainable forest management and operations

Johannes Rahlf, Stefano Puliti, Rasmus Astrup

Session Details - Thursday 21st

Santa Apollonia
Poccetti room

Forest Operations Management

Moderator: *Han-Sup Han*

Forecasting solutions for characterizing logging conditions and suitable weather conditions

Ainars Grinvalds, Arina Kirjanova

Trade-offs between wood flow and machine-use efficiency in harvesting operations

Malin Johansson, Mikael Lundbäck, Ola Lindroos

Surveying the central aspects of uncertainty mitigation in large-scale Swedish forestry

Oskar Gustavsson, Liviu Ene, Lovisa Engberg Sundström, Lars Eliasson

Using unmanned aerial vehicles to monitor implementation of forestry best management practices

Arjun Rijal, Richard Cristan, Tom Gallagher, Lana Narine

Carbon footprint of New Zealand's logging operations

Campbell Harvey, Simon Smith, Dougal Shepherd, Rien Visser

Forest operations: a tool for forest management

Han-Sup Han

Aula Magna
Umaform

Silviculture and wildfire management

Moderator: *M. Parajuli*

Thinning as a tool to increase resistance to stressors in the interior of British Columbia

Sergio Alonso, Dominik Röser

Zone thinning to increase harvesting productivity and forest structure variation

Heikki Ovaskainen, Asko Poikela, Matias Karhumaa

Promoting wildfire resilience using irregular shelterwood silvicultural system

Mingrui (Rover) Liu, Dominik Röser

Session Details - Thursday 21st

Optimal width of forest fire vehicles for access to Slovenian forests outside forest roads

Jaša Saražin,

Private forest owner willingness to mobilise wood from dense, small diameter tree stands

Matevž Triplat, Satu Helenius, Ruben Laina, Nike Krajnc, Thomas Kronholm, Zdenka Ženko, Teppo Hujala

Detecting and visualizing old logging trails for upcoming thinning operations

Omid Abdi, Jori Unsitalo, Veli-Pekka Kivinen, Ville Laamanen

Session Details - Friday 22nd

09:00 - 10:30

Technical sessions:

Santa Apollonia Auditorium Wood quality assessment, bucking optimization, and biomass estimation from machine and Lidar data

Moderator: M. Acuna

Evaluation of aspen (*Populus tremula*) timber strength parameters of roundwood assortments infected by fungi (*Phellinus tremulae*)

Ziedonis Miklaševičs, Natalija Burneviča, Jānis Iejavs

The effect of processor debarking at the forest road on wood quality deterioration during the interim storage of logs under alpine conditions

Stephan Böhm, Franz Holzleitner, Elias Amerhauser, Peter Baier, Christian Kanzjan

Session Details - Friday 22nd

Silver birch grading model based on regeneration harvest data

Jiří Dvořák, Martin Jankovský, Petr Moravec, Pavel Nator

Applying optimum bucking method to compare volume and value recovery of full tree and cut-to-length systems in South US

Carlos Diniz, Mathew Smidt

Maximized profit through integrated optimization of bucking selection and transport planning in the forest supply chain

Erik Rönnqvist, Mikael Frisk, Mikael Rönnqvist

Comparison of digital and traditional methods for the estimation of fuel biomass in wildfire-prone forested areas of the Mediterranean region.

Martino Rogai, Michele Salis, Lorenzo Arcidiaco, Andrea Berton, Carla Nati, Gianni Picchi

Aula Magna
UNIFI

Precision and automated tree planting

Moderator: M. Ramantswana

AI image recognition – Is a point good enough for tree planting or not?

Tomas Nordfjell, Alice Kårehagen

Automatic plant position selector for reforestation machines

Morgan Rossander, Songyu Li, Håkan Lideskog

SmartPlanter: a planting device for precision planting

Csongor Mark Horvath, Kjersti Holt Hanssen, Simon Berg, Rasmus Astrup

Autoplant – concepts and tests of autonomous forest regeneration

Linnea Hansson, Morgan Rossander, Håkan Lideskog, Gustav Sten, Ruben van Westendorp

Wood-fiber based Hydrogels

Gwendolin Hartmann, Benjamin Engler, Thomas Purfürst

Tool of time and space expansion in forestry for digital transformation and design

Toshio Nitami, Syunsuke Kaneko,

Session Details - Friday 22nd

Santa Apollonia
Pocchetti room

Digitalization

Moderator: *E. Cacot*

Industrialisation and Forestry 5.0 – digitalisation and automation

Carola Häggström, Erik Anerud, Camilla Widmark

Potential of blockchain technology in forest supply chains

Lukas Stopfer, Hans-Ulrich Dietz, Thomas Purfürst

Automatic detection of forest management units as a basis to optimally coordinate planning, forest operations and controlling in forest enterprises

Leo Gallus Bont, Lioba Rath, Janine Schweier

3D visualization for consultation

Sabrina St-Onge, Dominik Roeser, Shannon Hagerman

Forestry digitization using business design optimization tool and 3D display technology

Shunsuke Kaneko, Toshio Nitami, Takuyuki Yosbioka, Hyun Bae Kim

Leveraging immersive technology for enhanced learning in the forestry sector: a study on virtual and augmented reality applications

Alessa Angerschmid

Aula Magna
Umaform

Electrification

Moderator: *S. Leitner*

Battery vs petrol-powered chainsaw: productivity analysis in a conifer clear-cut

Francesco Neri, Andrea Laschi, Elena Marra, Fabio Fabiano, Niccolò Frassinelli, Enrico Marchi, Riccardo Paoloni, Cristiano Foderi

A comparison between battery- and petrol-powered chainsaws in terms of noise and vibrations exposure

Francesco Neri, Andrea Laschi, Lucia Bertuzzi, Giovanni Galipò, Niccolò Frassinelli, Fabio Fabiano, Enrico Marchi, Cristiano Foderi, Elena Marra

Comparison of motor-manual work with electric and petrol chainsaw

Benjamin Engler, Felipe de Miguel Diez, Gwendolin Hartmann, Thomas Purfürst

Session Details - Friday 22nd

Concepts of energy efficient electrified CTL forestry machines

Martin Englund, Morgan Rossander, Samuel Kärnell, Mats Zackrisson, Karin Ågren, Liselott Ericson

Roadmap to boost electric motorization of the Portuguese Forest Sector

Pedro Britto, Alexandra Marques, José Luis Carvalho, Susana Morais, Pedro Silva, Paulo Machado, Rui Igreja, Carlos Amaral Netto, João Gaspar, Jorge Filipe Martins, Carlos Viegas

10:30 - 11:00

Coffee break

11:10 - 12:40

Technical sessions:

Santa Apollonia
Auditorium

Determining soil impacts

Moderator: *L. Breinig*

Comparing the disturbances to the forest soil of beech high forests after ground-based timber extraction by skidding and forwarding

Francesco Latterini, Andrzej M. Jagodzinski, Pawel Horodecki, Rachele Venanzj, Damiano Tucci, Rodolfo Picchio

Comparison of soil bulk density, penetration resistance and rutting between forwarding and skidding

Elena Marra, Christian Höök, Enrico Marchi, Tomas Nordfjell

Soil structure changes caused by forestry machines with tracked and wheeled undercarriages and their natural regeneration

Herbert Borchert

Evaluation of soil erosion rates and implementation of best management practices in conventional and biomass harvest sites across the southeastern region of the United States

Manisha Parajuli, Tom Gallagher, Richard Cristan, Dana Mitchell, Marissa Jo Daniel, Timothy Mcdonald, Arjun Rijal

Predicting rut depth with soil moisture estimates from ERA5-Land and in-situ measurements

Marian Schönauer, Thilo Wagner, Dirk Jaeger

Accuracy of the calculating rut depth in lowland forest using three different measuring methods

Mihael Lovrinčević, David Janeš, Andreja Đuka, Maja Popović, Tibor Pentek, Tomislav Poršinsky, Zoran Bumber, Ivica Papa

Session Details - Friday 22nd

Aula Magna
UNIFI

Automatic wood tracking and loading operation

Moderator: A. Moura

Using deep learning for tracing logs and assessing log quality

Eero Holmström, Antti Raatevaara, Henna Kainulainen, Tuula Piri, Jonne Pohjanukku, Heikki Korhonen, Juba Honkaniemi, Mikko Peltoniemi, Aleksi Lehtonen, Jori Unsitalo

Accuracy and time consumption of LogStackLIDAR and iFovea Pro for volume calculation of stacked timber

Karol Tomczak, Maciej Piotrowski, Marta Pędzik, Patrycja Hochmańska-Kanienska, Ryszard Gąsiorowski, Piotr Mederski, Arkadiusz Tomczak

Individual log identification to improve supply chain efficiency

Keith Raymond, Andy Dick

A new methodological approach to expedite wood stacks measurement with smartphone Apps: a case study in eucalyptus and maritime pine plantations in Portugal

Mariana Amaro, Alexandra Marques, José Luis Carvalho, Maria Teresa Silva, Susana Moraes, Beatriz Lourenço, Afonso Costa, Reinaldo Gomes, Pedro Brito

Marker-free tracking of tree logs from harvest to the sawmill – Impact for sustainability

Catherine Last, Udo H. Sauter

Log-Loading automation with FPI crane testbed

Inna Sharf, Hesban Fernando, Jean-Francois Gingras

Santa Apollonia
Pocetti room

Forest Roads

Moderator: E. Bilici

Monitoring of forest roads with mobile laser scanning: automatic identification and measurement of cross section elements

Christoph Gollob, Ralf Krassnitzer, Tim Ritter, Andreas Tockner, Sarah Witzmann, Martin Kühmaier, Christian Kanžian, Ferdinand Hönigsberger, Alessa Angerschmid, Anna Saranti, Andreas Holzinger, Karl Stampfer, Arne Notthdurft

Modelling forest road trafficability with satellite radar

Dag Fjeld, Magnus Persson, Johan Fransson, Jan Bjerketvedt, Martin Bråthen

Session Details - Friday 22nd

Forest road surface monitoring using GNSS-aided dashcams and computer vision

Stephan Hoffmann, Mostafa Hoseini, Stefano Puliti, Rasmus Astrup

Optimizing landing locations using Lidar-derived single tree inventory and site factors using the Analytic Hierarchy Process

Ebru Bilici, Robert F. Keef, Mehmet Eker

Using LiDAR and RoadEng10 to evaluate the concept of benched forest road design in moderately steep terrain

Campbell Harvey, Rien Visser

Optimization of landings and main extraction trails

Mikael Frisk, Erik Rönngqvist, Mikael Rönngqvist

Aula Magna
Umaform

Steep Slopes Harvesting - Yarders and helicopters

Moderator: *O. Mologni*

Processor debarking in full-tree cable yarding operations

Franz Holzleitner, Elias Amerhauser, Christian Kanžian, Stephan Böhm

Skyline force estimation and limitation during cable yarding: a novel technical solution built into the carriage

Stefan Leitner, Raffaele Spinelli, Massimiliano Renzi, Renato Vidoni

Can state-of-the-art positioning technologies validate deflections in cable yarding?

Luca Marchi, Francesco Zanutto, Stefano Grigolato

Integration of Industry 4.0 concepts for optimising cable yarder operations

Patrick Humphrey, Rien Visser, Raffaele Spinelli

Setting up an experimentable digital twin for cable yarding systems

Michael Starke, Lennart Schinke, Arthur Wahl, Patrick Dietsch, Francesco Sforza, Michael Schluse, Martin Ziesak, Juergen Rossmann

Productivity and costs of the helicopter in the logging phase

Lorenzo Bonino, Federico Bertone, Marco Manzone

Session Details - Friday 22nd

12:40 - 13:40

Lunch

13:50 - 15:20

Technical sessions:

Santa Apollonia
Auditorium

Mitigating soil impacts

Moderator: *E. Marra*

On track of tracelessness - strategies to reduce soil impact of mechanized logging

Rolf Björheden

Portable soil protection systems – A technique for mitigating soil disturbance and improving access in ground-based logging operations?

Ingo Siebert, Raimund Schneider, Gebhard Schüler

Influence of two types of flotation bogie tracks on contact pressure distribution

Lorenz Breinig, Henrik Brokmeier, Dirk Jaeger

Developing the forest trafficability prediction through rolling resistance measured by forest vehicle

Aura Salmivaara, Jari Ala-Ilomäki, Sampo Kulju, Eero Holmström, Petra Virjonen, Paavo Nevalainen, Jukka Heikkonen, Samuli Launiainen

Assessment of the impacts on soil during wood extraction operations in the short-medium term

Riccardo Paoloni, Elena Marra, Cristiano Foderi, Francesco Neri, Stefano Grigolato

Navigating forests with machine learning-based path planning for the portal advancing mechanism

Sebastian Beiser, Benjamin Kazenwadel, Marcus Geimer

Session Details - Friday 22nd

Aula Magna
UNIFI

Enterprise, business and workforce

Moderator: *C. Blinn*

Analysis of decision-making processes for strategic technology investments in Swedish large-scale forestry

Rikard Lundqvist, Lotta Woxblom, Rolf Björheden, Eva-Maria Nordström, Bosko Blagojevic, Ola Lindroos

Subjective assessment of work ability versus efficiency of logging technology

Krzysztof Leszczynski

Regional comparison of independent logging businesses in the US South and Lake States

Joseph Conrad, Charles Blinn

Identification and Quantification of Systemic Challenges Affecting Logging Businesses in the US South and Lake States

Charles Blinn, Joseph Conrad

Evaluating the effectiveness and implementation barriers of logistics software for managing forest businesses

Chad Bolding, Joseph Conrad, Sarah Kinz, Josh Sego

Development of data-driven digital business models for forest road maintenance in Germany

Felipe De Miguel-Diez, Ferréol Berendt, Ina Ehrhardt, Tobias Cremer

Santa Apollonia
Pocetti room

Transport logistics and technology

Moderator: *C. Harvey*

Improving sustainability and resilience of wood logistics by transport simulation

Christoph Kogler, Peter Rauch

Simulating timber logistics based on a truck terminal – case Northern Finland

Perttu Anttila, Kari Väättäinen

Session Details - Friday 22nd

Automatic load securing system for improved log transport

Keith Raymond, Jared Silvester

Potential of the green reverse logistics in the pulp mill supply chain

Angelo Moura, Saulo Guerra, Yohanes Nuwara, Humberto Enfrade

A system integrator for better wood supply coordination: from OR to AI

Pedro Eboli, Luc Lebel, Luis Antonio de Santa-Eulalia

Intermodal timber transport logistics – operational and strategic planning in forestry

Hans-Ulrich Dietz, Thomas Smaltschinski, Thomas Purfuerst

Aula Magna
Umaform

Steep Terrain - Winch-assist

Moderator: F. Holzleitner

Full-automatic production analysis of winch-assist harvesting operations based on anchor machine configurations

Omar Mologni, Steffen Labrsen, Dominik Roeser

Minimum optimum recording frequency in tensile force monitoring of winch-assist harvesting operations

Mario Stolz, Omar Mologni, Dominik Roeser

Soils and steep slopes - is tethered cut-to-length a viable solution for mitigating soil impacts?

Preston Green, Charles Rhoades, Madeline Roberts

Safe Forests – does steep terrain effect psychophysiological stress and strain of harvesting machine operators?

Vera Foisner, Christoph Huber, Arnulf Hartl, Christoph Haas

Does the tree species influence the frictional performance of forestry ropes bent over trees?

Juergen Richter, Nikolaus Nemestothy, Christoph Huber

Innovative system to enhance synthetic rope in forest operations

Gerard Alcoverro Poch, Adriano Raddi, Gianni Picchi

Session Details - Friday 22nd

15:20 - 15:50 ————— Coffee break —————

16:00 - 17:30 Plenary Session:

Santa Apollonia
Auditorium

Closing ceremony

Next Meetings - Announcements - Conclusions

Post-conference tour to AUSTROFOMA 2023

Sunday 24th September 2023

Travelling from Firenze to Klagenfurt/Austria. Overnight stay in Klagenfurt (Ibis Styles Klagenfurt).

Monday 25th September 2023

Visit to Konrad Forsttechnik and EcoForst (T-Winch). Overnight stay near Leoben (Hotel und Restaurant - Brücklwirt).

Tuesday 26th September 2023

Bus transfer to Austrofoma and visit. At 16:00 bus transfer to Vienna, which will be reached around 19:00. End of the tour (BOKU, Peter Jordan Strasse 82, 1190 Vienna).

Poster session

Agile fuelbreak maintenance with multipurpose excavators equipped with mini-winch

Martino Rogai, Carla Nati, Gianni Picchi

Analyses on forest road damages between 2001 and 2019 using rainfall evaluation with return periods in Gunma prefecture, Japan

Kazuhiko Aruga, Issei Watanabe

Assessing the accuracy of HoloLens 2 applied to geographical information systems (GIS) for forest operations

Felipe de Miguel-Díez, Thomas Purfürst

Assessing the current state of forest road network development based on the concept of accessibility

Masaru Watanabe, Masashi Saito

Assessing the efficiency of mechanised hardwood thinning operations and tree quality features using machine time study data and LIDAR/AI technologies

Mauricio Acuna, Stephen Clarke, Martin Strandgard, Covadonga Prendes

Assessing the outer shape of sawlogs at the mill gate using stereo cameras and deep learning

Mostafa Hoseini, Carolin Fischer, Maciej Wielgosz, Csongor Horvath, Rasmus Astrup

Biochar production and heat generation through slow pyrolysis

Raitila J.

Bioenergy in a time of crisis

Raffaele Spinelli, Natascia Magagnotti, Robert Prinz, Johanna Routa, Janusz Golaszewski

Biomass Atlas makes Finnish biomass maps freely available to everyone

Eva Lehtonen, Perttu Anttila

Biomass hybrid dryer

Jyrki Raitila

Biomass terminals for securing wood chip supply

Kari Väättäinen, Jirki Raitila

Biomass vending machines

Natascia Magagnotti

Boom corridor thinning – a harvester's working method for young dense stands

Nautinen Y., Mubonen T.

Boosting rural bioeconomy by fostering knowledge transfer, enhancing competitiveness of biomass supply chains and promoting innovative technologies

Robert Prinz, Johanna Routa, Raffaele Spinelli

CALAHARI- Calamity adapted harvesting innovation

Lisa Jensen

CipCalor - An example of microgeneration in Italy

Natascia Magagnotti

Comparison of forest road prism measurements by various 3D measurement techniques

Masashi Saito, Masaru Watanabe, Kenichiro Toda, Yukio Sengoku

CTL transport management – a Nordic case study of work processes and organizational performance

Karl Sterner, Torbjörn Edman, Dag Fjeld,

Development of an automatic driving forwarder using in combination with LiDAR-SLAM and GNSS

Masahiko Nakazawa, Dai Otsuka, Seishiro Taki, Chikashi Yoshida, Hiroko Muneoka, Masahiro Iwaoka, Yasuo Nakashima, Atsushi Matsui

Development of hybrid drive of skidder

Marijan Šušnjar, Zdravko Pandur, Marin Bačić, Hrvoje Nevečerel, Mihael Čipek, Juraj Benić, Kruno Lepoglavec

Poster session

Digiforest project: technologies to achieve sustainable digital forestry

Janine Schweier, Holger Griess

Do rare saproxylic beetle species interfere with harvesting operations after bark beetle outbreaks?

Ivan Žarković, Milivoj Franjević, Kristijan Tomljanović, Ivica Papa, David Janež, Andreja Đuka, Dinko Vusić

Effects of harvesting systems on stand damage and productivity

Christoph Haas, Nikolaus Nemestothy, Christoph Huber

Energy wood supply chains organized by forest owners in Finland

Kalle Karttunen

ETN Skill-For. Actions Project, facing the forest carbon balance under the uncertain of the climate change

Narcis Mihail Bacescu, Filippo Guerra, Abhay Bharadwaj, Francesco Sforza, Gunta Grube, Logan Bingham, Daniel Minklaev, Otto Pienaar, Przemyslaw Jankowski, Bohdan Kolisnyk, Shamin Ahmed, Frederico Simões

Evaluation of forest operations on soil compaction in South Italian forests

Angelo Mammoliti, Maria F. Cataldo, Salvatore F Papandrea, Giuseppe Zimbalatti, Andrea R. Proto

Experiences from cable yarder productivities in horizontal yarding direction

Janine Schweier, Marc Werder, Leo G. Bont

Final review of rope end connectors available for forest applications

Juergen Richter, Nikolaus Nemestothy, Christoph Huber, Dominik Secklechner

Forest road geometry extraction with AI and large area airborne laser scanning

Johannes Rablf, Stephan Hoffmann, Rasmus Astrup

Forwarding damages to residual stand in beech even-aged high forests

Francesco Latterini, Rodolfo Picchio, Rachele Venanzi, Damiano Tocci, Nicolò Di Marzio, Paweł Horodecki, Andrzej M. Jagodziński

Grouted rock anchors for cable yarders: a New Zealand case study

Patrick Humphrey

Harvester seasons – a service supporting climate smart and sustainable forest operation planning

Miriam Kosmale, Mikko Strahlendorff, Asko Poikela, Heikki Ovaskainen, Anni Kröger, Mikko Moisander, Tuomo Smolander, Jaakko Ikonen

Highly mechanized and motor-manual harvesting technology in SRC

Frank Burger, Bettina Widmann

Hybrid-electric self-propelled carriage - First field tests

Stefan Leitner, Renato Vidoni, Massimiliano Renzi, Raffaele Spinelli

Implementing an operator protective device on quad-bikes - user experiences

Tomas Nordfjell, Thomas Kronholm, Björn Edlund, Carola Häggström, Peter Lundqvist

Intensify wood harvesting to supply the bioeconomy: impacts on site regeneration and cost-effectiveness

Claudie-Maude Canuel, Evelyne Thiffault, Nelson Thiffault

LiDAR-based automated methods for estimating the gross volume of industrial roundwood stacks

Felipe de Miguel-Díez, Maurico Acuna, Nikolai Knapp, Tobias Cremer, Thomas Purfürst

Logging machinery in Bulgaria - Past, present and future

Sotir Glushkov, Erik Findeisen, Ivailo Markoff, Rosen Novakov, Stefan Stoyanov, Dimitar Buyadzhev

Machine equipment of austrian forest enterprises and forest service companies

Nikolaus Nemestothy, Nikolaus Nemestothy, Jürgen Richter

Multispectral satellite time series for operational monitoring of oak forest dieback

Florian Mouret, Cécile Vincent-Barbaroux, Emmanuel Cacot

Overview of the integrity conditions of steel cables deployed in timber hauling with magneto-inductive sensor: a case study in Tuscany Region (Italy).

Fabio De Francesco, Gianni Picchi

Poster session

Pathfinder – A decision support tool for operational planning of integrated mechanical site preparation and planting on forest regeneration areas

Linnea Hansson, Patrik Flisberg, Mikael Rönqvist, Fredrik Johansson, Rasmus Sörensen, Petrus Jönsson

Performance of a Mounity4000 cable yarder with Woody H Faucet processor

Sotir Glushkov, Dimitar Boyadzhiev, Ivailo Markoff

Prediction of soil strength

Andreas Hagenbo, Nils Egil Søvde, Stephan Hoffmann, Simon Berg

Production of microchips - high quality chips used as pellet replacement

Raffaele Spinelli

Productivity analysis and costs of wheel cable skidder during salvage logging in European beech stand

Salvatore F. Papandrea, Maria F. Cataldo, Stanimir Stoilov, Georgi Angelov, Delyan Oslekov, Giuseppe Zimbalatti, Andrea R. Proto

Productivity analysis of skidding operations using UAV video captures integrate with Weibull distribution method

Halit Büyüksakalli, Ebru Bilici, Abdullah E. Akay

Project IntelliWay – Intelligent road condition monitoring and predictive maintenance for forest roads

Marian Schönauer, Thilo Wagner

Rail transport in Swedish wood supply – seasonal variation, system risks and mitigation costs

Ida Sjölling, Erik Rönqvist, Dag Fjeld

RASEN - A biomass district heating plant

Benno Eberhard

Resource-efficiency and time consumption for CTL beech wood harvesting with top and bottom-saw

Benjamin Engler, Gwendolin Hartmann, Hans-Ulrich Dietz, Thomas Purfürst

Poster session

Risupeto - a novel felling head for efficient harvesting of small diameter wood biomass

Juha Laitila, Kari Väättäinen

RTK-GNSS accurately detects the position of the rotary blade of a hand-held engine brush cutter.

Tetsuya Matsumura

Rubber-tracked forwarders – productivity and cost efficiency potentials

Mikael Lundbäck, Ola Lindroos, Martin Servin

Seilaplan: A QGIS plugin for optimized cable road layout planning

Leo Gallus Bont, Laura Ramstein, Patricia Moll, Janine Schweier

Small-scale pellet production as an opportunity for forest owners and operators

Raffaele Spinelli

SmartForest – Digital transformation of the Norwegian forest sector

Carolin Fischer, Rasmus Astrup

Suspension risk analysis to promote use of cablecrane for quality oak

Didier Pischedda

Technodiversity – Harmonising European education in forest engineering by implementing an e-learning platform to support adaptation and evaluation of forest operations

Andreja Duka, Jörn Erler, Piotr Mederski, Stelian A. Borz, Ola Lindroos, Karl Stampfer, Philippe Ruch, Rafaele Spinelli

The contribution of SINTETIC project in the frame of the forthcoming EUDR timber trade regulation

Gianni Picchi, Carla Nati

The solution is in expertise – Wood supply vision 2030 for the Finnish forestry

Jukka Malinen

Poster session

The virtual wood supply arena – performance benchmarking after one year of on-line testing

Dag Fjeld, Philippe Marier, Björn Edlund, Lars Eliasson, Mikael Frisk, Mikael Rönngvist

The volume of logging residues and wood chips produced from Norway spruce regeneration fellings

Martin Jankovský, Jiří Dvořák, Josef Michna, Pavel Natov

Use of mobile device inertial measurement unit (IMU) and real-time kinetic (RTK) GNSS to quantify ergonomic differences among tracked and rubber-tired grapple skidders.

Axel Wall, Rob Keefe, Ebru Bilici

Virtual reality forestry training (VR-FT)

Mark-Fabian Franz, Elena Früchtenicht, Andrea Teutenberg

Field Trip - Wednesday 20th September

08:00 Departure

Participants will be picked up in Florence by charter buses and taken to Pistoia and its surroundings. The meeting point is in Via Elio Gabbuggiani. From the train station take the bus/metro in direction Villa Costanza.



The tour will include visits to the following sites:

- Nursery using forest chips for mulching to replace glyphosate
- Steep terrain logging operation - yarding
- Small-scale wood terminal and satellite landing – chipping – firewood processing
- Chip-fired heating plant (public building complex)

Lunch will be provided by a local farm, based on local specialties (homemade goat cheese, pork roast on a spit and vegetarian option)

17:00 Arrival in Florence

What to Bring: Hiking boots/shoes, hat, warm clothing, raincoat, water (additional water will be available at lunch). Helmets and high-visibility vest will be provided by the organizers.



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The image shows a promotional graphic for Ecoforst. At the top, there is a stylized tree icon and the text "ecoforst" in a lowercase sans-serif font, with "PROGRESS OF TECHNOLOGY" in smaller letters underneath. Below this, the word "TWINCH" is written in large, bold, white capital letters, with the "T" enclosed in a white circle. The background of the top half is a solid green color. Below the text is a photograph of two green and blue tracked logging machines in a forest setting. The bottom half of the graphic is a solid green background with the text "Traction assist winches designed from loggers for loggers" in white. At the very bottom, on a dark grey background, is the website address "www.ecoforst.at".

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The image is a promotional graphic for Greifenberg teleferiche. On the left side, there is a large, stylized logo consisting of a gear and a leaf, with the letters "G" and "G" integrated into the design. Below the logo is the text "greifenberg teleferiche" in a lowercase sans-serif font. On the right side, there is a photograph of two workers wearing yellow and orange hard hats, looking at a large blueprint spread out on a table. A white hard hat is also visible on the table. Above the photograph, there is a quote in white capital letters: "CONCERN FOR MAN AND HIS DESTINY MUST ALWAYS BE THE PRIMARY CONCERN OF ALL TECHNICAL ENDEAVOURS. NEVER FORGET THIS IN THE MIDST OF ALL YOUR DIAGRAMS AND EQUATIONS ALBERT EINSTEIN". Below the photograph is the website address "www.greifenberg.it" in white. At the bottom of the graphic, on a black background, is the text "Cable logging and forestry equipment" in white.

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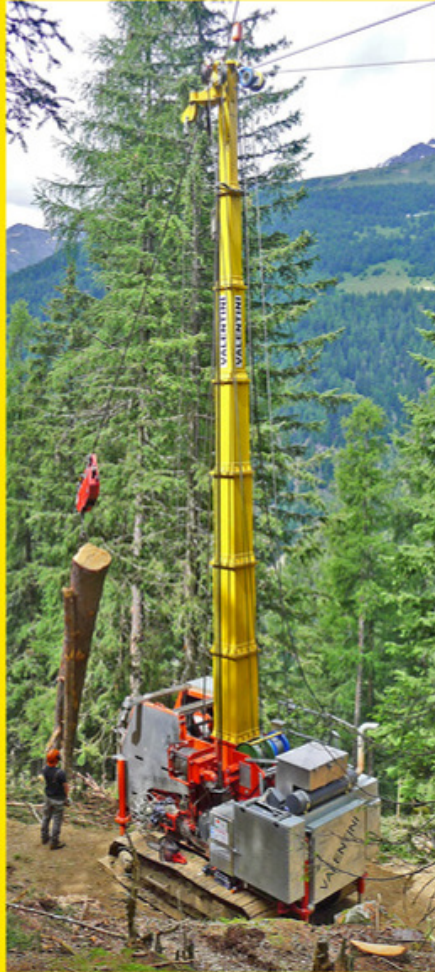
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Thanks to all partners and participants for taking part in the event and for all the valuable contributions and collaboration in organizing it!





Contact information

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Thank you!

