

Međunarodno znanstveno savjetovanje FORMEC *Improved Forest Mechanisation: Mobilizing natural resources and preventing wildfires*, Madrid, Španjolska, 24-27. rujna 2018.

U Madridu je od 24. do 27. rujna 2018. godine održano 51. međunarodno znanstveno savjetovanje udruženja FORMEC pod naslovom *Improved Forest Mechanisation: Mobilizing natural resources and preventing wildfires* u organizaciji Sveučilišta u Madridu, odnosno Zavoda za šumarske tehnike i tehnologije pod vodstvom profesora Eduarda Tolosane i profesora Rubéna Lainea.

Svrha savjetovanja bilo je predstavljanje novih znanstvenih i operativnih spoznaja s glavnim težištem prema prevenciji šumskih požara u sredozemnim područjima, ali i druženje te razmjena iskustava, znanja i vještina među znanstvenicima, istraživačima i operativcima u prvom redu na području tehnika i tehnologija, ali i šumarstva općenito. Znanstveni odbor savjetovanja bio je u sastavu: Mauricio Acuña (Sveučilište »Sunshine Coast«, Australija), Raffaele Cavalli (Sveučilište u Padovi, Italija), Hans Rudolf Heinemann (Švicarski savezni institut tehnologije, Švicarska), Tadeusz Moskalik



Slika 1. Otvaranje međunarodnoga znanstvenoga savjetovanja FORMEC 2018

Fig. 1 Opening ceremony of the International Scientific Conference FORMEC 2018

(Poljoprivredno sveučilište u Varšavi, Poljska), Ivica Papa (Šumarski fakultet Sveučilišta u Zagrebu, Hrvatska), Tibor Pentek (Šumarski fakultet Sveučilišta u Zagrebu, Hrvatska), Eduardo Tolosana (Sveučilište u Madridu, Španjolska) i Rien Visser (Sveučilište Canterbury, Novi Zeland).

Na savjetovanju je prisustvovalo 149 znanstvenika iz 24 zemlje, podijeljenih u četiri sesije. Savjetovanje se sastojalo od 7 pozvanih predavanja, 87 usmenih priopćenja i 19 postera. Također, treba spomenuti kako je 10 predavanja bilo vezano uz glavnu temu savjetovanja, odnosno uz šumske požare u Australiji, SAD-u, Italiji i Španjolskoj. Članovi Zavoda za šumarske tehnike i tehnologije Šumarskoga fakulteta Sveučilišta u Zagrebu održali su četiri usmena izlaganja.

Savjetovanje je otvoreno pozdravnim govorima prorektora Sveučilišta u Madridu Francisca Javier Jiméneza Leubea, prodekana Sveučilišta u Madridu Joséa Ramóna González Adradosa te dvaju predsjednika organizacijskih odbora savjetovanja FORMEC 2018, profesora Eduarda Tolosane i profesora Imre Czupya. Nakon stanke savjetovanje se nastavilo dvjema plenarnim sesijama (moderator je bio Eduardo Tolosana) u kojima su redom izlagali:

Raffaele Spinelli: *Mechanization of forest operations: new developments, trends and challenges*

Manuel López Sánchez: *TQM: Applications to forest mechanized harvesting planning and control: the ENCE Spanish case-study in Eucalyptus operations*

Karl Stampfer: *State of the art of European tower yarder manufacturers and models*

Mauricio Acuña: *Frontiers in Logistics optimization of wood and biomass supply chains*

Juan Bautista García Ejido: *Mechanization and operational control in wildfire fighting*

Luis Saul Esteban Pascual: *Innovative wildfire preventive mechanized operations.*

Nakon stanke za ručak otvorena je i posterska sesija, a potom je nastavljen rad u četirima uspo-rednim sesijama. U nastavku se navode sva usmena izlaganja koja su bila održana tijekom savjetovanja.

U sesiji A1 pod naslovom *Forestry contractors and enterprises* moderator je bio Ola Lindroos, a u njoj su održana ova izlaganja:

R. Astrup, N. Strange, P. J. Kerstens, P. Bogetoft, H.-U. Dietz, G. Aalmo, B. Talbot: *The TECH4EFFECT Efficiency Portal: architecture, challenges, and preliminary outcomes of an ambitious benchmarking system*

H. Haavikko, K. Kärhä, M. Hourula, T. Palander: *Energy efficiency of small and medium-sized enterprises in wood procurement: a case study of Stora Enso in Finland*

F. Neri, F. Fabiano, A. Laschi, P. Cielo, R. M. Ricart: *The European Chainsaw Certificate (ECC) since 2009 to 2018: development and activities*

N. Krajnc, M. Triplat: *Web-based service for assessment of forestry contractors – the case of Slovenia*

M. Vuillermoz, P. Ruch, P. Magaud: *Lessons learnt from capacity building research-action with professional wood mobilisers: tackling the knowledge-transfer challenge*

J. Martínez-Trepat, P. Navarro, J. Pemán, G. Picchi: *Analysis of Forest Enterprises in Catalonia.*

U sesiji A2 pod naslovom *Infrastructural planning for forest operations* moderator je bila Andreja Đuka, a održana su ova izlaganja:

L. G. Bont: *Optimizing the layout of an existing forest road network in steep terrain*

D. Fjeld, M. Rönnqvist, P. Flisberg: *Developing methods for truck route selection and cost modelling in steeper topographies*

M. Fraefel, L. G. Bont, C. Fischer: *A spatially explicit timber harvesting and transport model*

D. Janeš, A. Đuka, I. Papa, T. Poršinsky, Ž. Tomašić, T. Pentek: *Terrain classification for timber harvesting and forest accessibility*

M. Acuña, G. Murphy: *Productivity and Economic Impacts of Harvesting with Spatial and Size Constraints.*

U sesiji A3 pod naslovom *The human factor in forest operations: new developments in ergonomics, safety and health* moderirao je Emmanuel Cacot, a u njoj su održana ova izlaganja:

S. A. Borz, N. Talagai, M. Cheța, D. Chiriloiu, A. Gavilanes, D. D. Castillo: *Physical strain, exposure to noise and postural assessment of motor-manual felling of willow short rotation coppice using brush cutters*

T. Nitami, S. Sooil: *Smart Chainsaw – ICT and IOT on manual chainsaw operation for safety and productivity at forestry operation*

J. M. Sowa, G. Szewczyk, J. Groborz: *The variability in visual perception of a working space of a harvester's operator*

M. Landekić, M. Šporčić, I. Martinić, M. Šušnjar, Z. Pandur, M. Bačić: *Evaluation and Comparison of Forest Machinery Operators' Cardiovascular Workload*

E. Kastenholz, H. Habenicht, J. Kampe, K. Klöber, C. Kreil, J. Morat, S. Paritschkow, A. Teutenberg, F. Zahnreich, U. Seeling: *Fitting Health and Safety Measures to Needs and Conditions of Enterprises.*

U sesiji A4 pod naslovom *Mechanized systems and planning tools for forest fire prevention* moderator je bio Andrea Laschi, a održana se ova izlaganja:

G. Aminti, A. Cinotti, C. Lombardini, R. Spinelli, G. Picchi: *Industrial stress-test of a Magnetic resonance moisture meter for woody biomass in Mediterranean conditions*

M. Acuña, G. Murphy: *Fuel load reduction with mechanized harvesting equipment: productivity results from trials in Australia*

E. Tolosana, R. Laina: *Post-fire regenerated mixed stand thinning and biomass harvesting with a Fixteri feller-bundler in Spain: environmental, productivity and cost analysis*

R. Bados, E., Tolosana, L. S. Esteban: *Biomass collection from wildfire prevention treatment on Rockrose shrublands using a brushcutterbundler Biobaler WB55 in Soria (Spain)*

D. Vusić, Z. Benčik, T. Kos, Ž. Zečić: *Natural drying of Aleppo pine (Pinus halepensis Mill.) biomass.*

Nakon održanih predavanja sudionicima je priređena pozdravna večera, tzv. *Welcome Dinner*, u restoranu La Azotea de San Antonna, smještenom u središtu Madrida.

Drugoga dana savjetovanja održana su ostala predavanja u po četiri usporedne sesije u ovim terminima: 08:30–10:30, zatim 11:00–13:00 te posljednja sesija u terminu od 14:30 do 16:30 h.

Sesijom B1 pod naslovom *New developments in forest machinery* moderirao je Eduardo Tolosana, a u njoj su održana ova izlaganja:

J. B. Heppelmann, E. R. Labelle, U. Seeling, S. Wittkopf: *Debarking Heads, a potential solution to modern forestry challenges in Europe?*

J. Sandak, A. Sandak, G. Picchi: *Development of a sensorized timber processor head*

J. Schweier, F. Berendt, M. Fortin: *Timber hauling with a remote-controlled mini forestry crawler*

C. Geiger, M. Starke, D. Greff, M. Geimer: *The Potential of a Weight Detection System for Forwarders using an Artificial Neural Network*

D. Bergström: *Simulation and cost comparison of three innovative biomass harvesting systems for young dense thinning*

J. Routa, A. Asikainen, V.-M. Saarinen: *Productivity and cost-efficiency of mechanizing tending with Cutlink device in spruce seedling stands.*

U sesiji B2 pod naslovom *Planning forest operations: new tools for analysis and optimization* moderatorica je bila Mika Yoshida, a u njoj su održana ova izlaganja:

J. Kemmerer, E. R. Labelle: *Harvester on-board computer data - How can we use it to improve the forest supply chain in Germany?*

M. Kopetzky, H.-U. Dietz, U. Seeling: *Digitising Communication from Harvesters to Sawmills in the German Forest and Wood Industry Sector*

K. Kärhä, M. Räsänen, T. Palander: *Evaluation of Optimal Cross-cutting Method for Butt-rotten Norway spruce Stands*

T. Nordfjell, J. Pettersson, O. Lindroos: *The effect of a stand's tree volume variation on harvester productivity*

J. Dvořák, P. Natov, M. Chytrý, M. Jankovský: *Analysis of unregistered timber volume in allowance in Cut-To-Length logging*

B. Blagojević, R. Jonsson, R. Björheden, E.-M. Nordström, O. Lindroos: *Multi-criteria decision analysis (MCDA) in forest operations – at tutorial review.*

U sesiji B3 pod naslovom *Forest operations best practices: for a better environmental performance* moderatorica je Teresa de la Fuente, a održana su ova izlaganja:

B. Talbot, R. Astrup: *Developments in post-harvest site assessments and their potential for improving operational and environmental performance*

A. Asikainen: *Promise of digitalization for forest operations and monitoring of disturbances*

D. Fjeld, Ø. Østby-Bertsen, B. Talbot: *The effects of an extra forwarder axle on wheel rut development* E. Cacot,

C. Boldrini, L. Saint Andre, N. Bilot, I. Bilger, C. Deleuze, G. Landmann: *Survey of harvesting practices for wood chips in France: synthesis and recommendations on harvesting practices to increase environmental performance*

E. Lee, Q. Li, S. Eu, Y.-E. Lee, S. Im: *Soil disturbance of a small-shovel logging system in South Korea.*

U sesiji B4 pod naslovom *Mechanized wildfire fighting and restoration in a global change era + Forest machines costing moderator* je bio Rubén Laina:

M. Smidt, D. Mitchell, D. Baker: *Use of large capacity site preparation machines for fire line establishment in the Southern US*

J. B. García-Ejido, A. Lara, R. Laina: *Factors affecting dozer production rate for constructing firelines in wild-land fires extinction in Spain*

F. Rossi, G. Becker: *AUV-supported delineation of forest affected by mixed-severity fires: establishment of homogeneous management units with the tool Hot Spot Analysis (Getis-Ord Gi*)*

A. Laschi, C. Foderi, F. Fabiano, F. Neri, M. Cambi, B. Mariotti, E. Marchi: *Forest Road Network in fire-prone environment: planning, construction and maintenance for an efficient role in fire fighting.*

Janine Schweier moderirala je sesijom C1 pod naslovom *Productivity study of innovative forest operations:*

E. Tolosana, R. Spinelli, G. Aminti, R. Laina, I. Lopez-Vicens: *Productivity, Efficiency and Environmental Effects of Whole-Tree Harvesting in Spanish Coppice Stands Using a Drive-to-Tree Disc Saw Feller-Buncher*

P. A. Tsioras, Z. Karaszewski, P. S. Mederski, M. Bembenek: *Implementation of medium-sized harvesters in coppice stands: Performance and potential environmental risks*

L. Breinig, E. Sycheva, E. R. Labelle: *Productivity of CTL harvesters in hardwood harvesting*

D. Vusić, M. Plantak, I. Papa, A. Đuka, T. Pentek, T. Poršinsky: *Analysing the efficiency of mechanised thinning in broadleaf stands*

H. Borchert, A. Winterling, F. Burger, K. Wiesinger: *The Profitability of Different Methods of Weed Control when Establishing Short Rotation Coppice in Organic Farming.*

U sesiji C2 naslovljenoj *Biomass supply chains: logistics and optimization* moderator je bio Mauricio Acuña, a u njoj su održana ova izlaganja:

Y. Wang, J. Wang, D. Hartley, J. Schuler: *Multiple biomass feedstock harvest and logistics in the Northeastern United States*

M. Yoshida: *Simulation of mobile wood chip production considering uncertainty inside a supply chain*

K. Karttunen, M. Laihanen, A. Karhunen, T. Ranta: *Supply potential and cost of forest biomass for the small and large-scale demand sites at the regional level in Finland*

S. Berg, D. Athanassiadis: *A New model for locating terminals optimally in reference to the resource base, terminal type and infrastructure*

R. Fernández-Lacruz, A. Eriksson, D. Bergström: *Direct versus via-terminal supply of forest residual biomasses: a simulationbased analysis*

L. Westerlund, D. Bergström, L. Fridh: *Calibration of a handheld capacitance-based moisture meter for use in forest fuel supply management.*

U sesiji C3 pod naslovom *Environmental effects of forest operations* moderirao je Antti Asikainen, a održana su ova izlaganja:

M. Cambi, B. Mariotti, E. Marra, E. Paoletti, Z. Feng, E. Marchi, Y. Hoshika: *Effect of soil compaction on tree growth: a meta-analysis*

K. J. Lemmer, E. R. Labelle: *Environmental impacts of forest harvesting operations along a gradient of mechanization*

T. Nordfjell, E. Marchi, W. Chung, R. Visser, D. Abbas, P. S. Mederski, A. McEwan, M. Brink, A. Lashchi: *Sustainable Forest Operations (SFO): a new paradigm*

S. Mohtashami, L. Eliasson, E. Willén: *Effects of soil clay content on rut formation*

A. Stańczykiewicz, D. Kulak, K. Leszczyński, J. M. Sowa, G. Szewczyk: *Probability of damage to regeneration due to timber harvesting in thinned stands*

M. Martin A. Chanzy, L. Lassabatère, N. Pousse, P. Ruch, S. Ruy: *Assessment of forest soil hydraulic parameters by infiltration experiments to measure compaction intensity of harvesting trails.*

Sesija C4 održavala se pod naslovom *Biomass: potential evaluation, processes and technologies*, a njome je moderirao Kalle Kärhä. Održana su ova izlaganja:

O. Thees, M. Erni, R. Lemm, G. Stadelmann, E. Zenner: *Modeling the Realistically Sustainable Potential of Forest Wood Supplies for Energetic use*

I. Czupy, V. Papp, D. Szalay, B. Horváth, A. Vágvölgyi: *Forestry residues as potential base material of heat production*

R. Spinelli, N. Magagnotti: *Production of microchips as a surrogate of pellets: techniques and cost*

D. Bergstrom, F. di Fulvio: *Systematic review of efficiencies in comminuting of forest fuels*

T. de la Fuente, D. Bergström, S. González-García, S. H. Larsson: *Life cycle assessment of decentralized mobile production systems for pelletizing logging residues under Nordic conditions.*

Nakon pauze za ručak nastavljeno je s predavanjima u četirima usporednim sesijama.

U sesiji D1 *Facing mountainous stands challenges to forest operations* moderator je bio Karl Stampfer:

O. Mologni, P. Dyson, D. Amishev, R. Cavalli, S. Grigolato: *Winch-assist forwarders operating in British Columbia: productivity and tension monitoring*

O. Mologni, A. R. Proto, G. Zimbalatti, K. Lyons, R. Cavalli: *Skyline tension monitoring of cable yarding systems in the Italian Alps*

T. Holzfeind, K. Stampfer, F. Holzleitner: *Productivity, Setup Time and Costs of a Winch Assisted Forwarder*

C. Munteanu, M. Yoshida, S. A. Borz: *Performance of gravitational cable yarding operations in steep-terrain group shelterwood silvicultural systems*

C. Knobloch, L. Bont: *A new method to compute mechanical properties of a cable road skyline.*

U sesiji D2 pod naslovom *Environmental effects of forest operations* moderirao je Tomas Nördjfel, a održana su ova izlaganja:

M. Ziesak, P. Dietsch, M. Günter, J.-J. Thormann, C. Condrau: *Improved planning for silviculture and forestry engineering in cable crane operations with drone technology – precision analysis and validation of the suitability*

M. Acuña: *Sensor Technology for Volumetric Measurements of Truckloads*

L. Bont, L. Ene, A. Hill: *Use of large inventory data sets and remote sensing data to analyze stand structure parameter relevant for wood harvesting and forest operations*

G. Erber: *First accuracy test of a novel mobile device based application for valueoptimized bucking in motor-manual harvesting operations*

D. Garcia-Castillo, J. L. Tomé, A. Fernández-Landa: *ForestMap: Quick and cost-effective integrated web platform for forest inventories.*

U sesiji D3 naslovljenoj *Global change, new challenges for forest operational planning* moderator je bio Raffaele Spinelli, a u njoj su održana ova izlaganja:

R. Spinelli, N. Magagnotti, J. Schweier, B. Wolfslehner, M. Lexer: *Sustainability Impact Assessment of alternative thinning operations in Mediterranean umbrella pine plantations*

R. Prinz, R. Spinelli, N. Magagnotti, J. Routa, A. Asikainen: *Manipulating work setting to reduce fuel consumption in CTL timber harvesting machines*

D. Fjeld, J. Bjerketvedt, M. Fønhus: *Modeling seasonal bearing capacity for production scheduling in Norway*

D. Lazdina, K. Makovskis, A. Lazdins: *Mounding and mechanized planting for forest regeneration in changing climate conditions*

M. Irdla, A. Padari, P. Muiste: *The impact of weather conditions on fuel consumption of comminution and transport of wood raw material in Estonian conditions – a case study*

D. Fjeld, P. Lunde: *Seasonality of wood supply operations in coastal Norway.*

Imre Czupy moderirao je sesijom D4 *Biofuels storage: quality and moisture:*

N. Hofmann, F. Schulmeyer, F. Burger, M. Riebler, H. Borchert: *Influence of moisture content on oxygen consumption of wood chips – determination of the storage-stable moisture content*

S. Lesche, T. Mendel, R. Mack, D. Kuptz, H. Hartmann: *Alternative preservation methods to minimize dry matter losses and to maintain fuel quality during wood chip storage*

D. Kuptz, K. Schreiber, F. Schulmeyer, T. Zeng, A. Pollex, V. Zelinski, M. Volgmann, H. Borchert, H. Hartmann: *Meeting fuel specifications of ENplus wood chips by screening and drying of forest residues*

T. Mendel, D. Kuptz, H. Hartmann: *Effect of screening on storage behaviour or wood chips*

L. Roca, *Final customer experience linked to supply experience. Gestamp Biomass' experience, recommendations and requests to the community*

L. Eliasson, H. von Hofsten, Ö. Grönlund: *The effects of coverage on logging residue moisture content after storage.*

Kao i prethodnih godina, dodijeljene se novčane nagrade za najbolju prezentaciju, drugu najbolju prezentaciju te najbolji poster. Četvrtoga, posljed-



Slika 2. a) Demonstracija gašenja šumskoga požara helikopterom; b) izvoženje celuloznoga drva forvarderom; c) pridobivane biomase za energiju biobalerom

Fig. 2. a) Demonstration of forest firefighting by a helicopter; b) Forwarder Transport of Pulpwood; c) Biobaler in energy biomass harvesting

njega dana savjetovanja za sudionike je organiziran terenski izlet koji je uključivao posjet vatrogasnoj jedinici, koja je demonstrirala gašenje šumskoga požara helikopterom, nakon čega je slijedio obilazak mješovite sastojine koja se prorjeđuje mehaniziranim načinom (sustav pridobivanja drva harvester – forwarder). Poslije stanke za ručak slijedio je dio terenskoga izleta na kojem je demonstrirana primjena biobalera u pridobivanju biomase za energiju. Završni dio izleta temeljio se na obilasku sastojina četinjača smještenih u gorskim predjelima Španjolske, gdje je također pokazana strojna proređiva sastojine.

David Janeš