

CONTENTS

Editor's Note 3

Technical Papers

Individual Stem Value Recovery of Modified and Conventional Tree-length Systems
in the Southeastern United States
Amanda H. Lang, Shawn A. Baker, W. Dale Greene, and Glen E. Murphy 7

Development of a Correlation Model between a 20-kg Clegg Hammer and Field CBR
for Measuring Subgrade Strength in Forest Roads in Western Oregon
Justin Pattison, Kevin Boston, and Marv Pyles 12

Scrutinizing the Theory of Comparative Time Studies with Operator as a Block Effect
Ola Lindroos 20

Compression Processing and Load Compression of Young Scots Pine and Birch Trees
in Thinnings for Bioenergy
Dan Bergström, Tomas Nordfjell, and Urban Bergsten 31

A Comparison of Harvesting Systems for Western Juniper
Elizabeth M. Dodson 40

Production of a Roll-off Equipped Harwarder for Forest Biomass Utilization
Aaron Kash and Elizabeth M Dodson 48

**INTERNATIONAL
JOURNAL OF
FOREST ENGINEERING**

Founding Editor

Jeremy Rickards
University of New Brunswick
Fredericton, CANADA

Editor Emeritus

Marvin R. Pyles
Oregon State University
Oregon, USA

Technical Editor

Cornelis R. de Hoop
Louisiana State University
Agricultural Center
Baton Rouge, USA

Editorial Board

Antti Asikaninen

Finnish Forest Research Institute
Joensuu, FINLAND

Rolf Bjorheden

Vaxjo University
SWEDEN

Mark Brown

University of Melbourne
Creswick, AUSTRALIA

Bo Dahlin

University of Helsinki
Helsinki, FINLAND

Robert A. Douglas

Golder Associates
Toronto, CANADA

Dennis Dykstra

USDA Forest Service
Oregon, USA

Paul Efthymiou

Aristotle University of Thessaloniki
Thessaloniki, GREECE

Daniel Guimier

Forest Engineering Research
Institute of Canada
Pointe Claire, CANADA

Wang Li Hai

Harbin University
Harbin, CHINA

Bostjan Kosir

Slovenian Forest Institute
Ljubljana, SLOVENIA

C. Kevin Lyons

University of British Columbia
Vancouver, CANADA

Jorge Malinovski

Federal University of Parana
Curitiba, BRAZIL

Reino Pulkki

Lakehead University
Thunder Bay, CANADA

Marvin Pyles

Oregon State University
Corvallis, USA

Lorne Riley

Environmental Forestry Consultant
Kanata, CANADA

Robert Rummer

USDA Forest Service
Auburn University, USA

Masami Shiba

Kyoto University
Kyoto, JAPAN

William Stuart

Mississippi State University
Mississippi State, USA

Raymond Yong

University of Wales
Cardiff, UNITED KINGDOM

Editor's Note

Susan Stamm has been serving as copy editor of this Journal, even serving as acting managing editor during the time the Forest Products Society was between permanent executive vice presidents. She resigned from the Forest Products Society in October 2009 and is certainly missed. Many thanks for your work and diligence, Susan. We wish you the best in your endeavors.

The Forest Products Society has contracted with Debra Illingworth Greene to do our copy editing of the *IJFE*. So, welcome, Debra, to the *IJFE*. May we produce many successful issues together.

The shift in emphasis in forest operations research toward woody biomass utilization has been dramatic lately. This issue of *IJFE* is no exception. Every article, with one exception, relates directly to woody biomass for energy in some way. The exception is an article on roads; and I would be willing to wager money that the road used for testing will convey energy wood at some point in the future. Cubic meters, board feet, cords, and cunits are being replaced by tonnes, moisture content, kilojoules, kilowatt-hours, and BTUs. Loggers who once drove over small trees to access the big ones now ask themselves how they can harvest those small trees.

It is with good purpose that we shift our emphasis toward wood for energy. Two years ago, a consulting engineer from Houston, Texas, told me that his company had a dozen new types of biomass-utilizing plants designed, with funding lined up and ready to start building. The only holdup was location – they did not know where to locate these plants so that a steady long-term supply of raw material was confidently assured. Obviously, competent information about the long-term supplies of biomass, by geography, is critical in answering the engineer's questions.

Another piece of critical information is the cost of harvesting and transporting biomass. When one considers that roughly half of bioenergy costs lie in the harvesting and transportation of the raw material, it is obvious that this is the field of greatest potential for economic improvement. Not only would biomass become more cost-competitive with other sources of energy, but the issue of locating facilities precisely within plentiful raw material supplies becomes slightly less critical if raw material cost decreases.

So, once again, forest engineering and operations research are little-known but critical components in the economic engine that drives our society – this time, literally. As we (as a society) look to diversify our energy sources, the work that we (as forest engineers, loggers, foresters, researchers, etc.) do becomes essential.

Cornelis F. "Niels" de Hoop
Technical Editor

Tell Us About Your Organization

One dimension of the mission of the *International Journal of Forest Engineering (IJFE)* is to help link the worldwide forest engineering community. There is a host of research institutions and groups, technology development units, and departments spread throughout most forested countries of the world. The *IJFE* would like to publish brief profiles of the research and development groups, institutes, and organizations whose activities overlap with *IJFE*'s technical scope.

The profiles should describe the technical and geographic scope of the organization, their location, a brief list of some publications and products that represent the work conducted, and a description of the organization itself (location, number of staff, affiliation with university or government institutions, and key personnel). In addition, complete contact information should be provided to allow further contact by readers.

Each profile should be no longer than one page in the *IJFE*. Text, artwork, logos, or icons used in the profile must be provided in electronic format. Submissions should include a contact person for editorial changes or questions.

Please submit profiles to:

Niels de Hoop, Technical Editor
International Journal of Forest Engineering
LSU Agricultural Center
School of Renewable Natural Resources
227 RNR Bldg
Baton Rouge, LA 70803-6202 USA
E-mail: cdehoop@lsu.edu

Scope

The *International Journal of Forest Engineering (IJFE)* is dedicated to the dissemination of scholarly writings in all aspects of forest operations, focusing on original research, but also including review, analysis, and synthesis articles. Article topics include: tree harvesting, processing, and transportation; stand establishment, protection, and tending; operations planning and control; machine design, management, and evaluation; forest access planning and construction; human factors engineering (ergonomics); and education and training.

An important role of the *IJFE* is to report on existing practices and innovations in forest engineering by scientists and professionals from around the world that promote environmentally sound forestry practices and contribute to sustainable forest management.

Published semiannually, the *IJFE* is committed to serving the international forest engineering community as the voice of new ideas and developments in forest engineering.

Submission Instructions for New Manuscripts

Although its readership is international, the *International Journal of Forest Engineering (IJFE)* is published in English. Authors are requested to ensure that their papers have been carefully proofread, preferably by a fluent English speaker. Manuscripts that have been insufficiently proofread for English usage will be returned for improvement before review, leading to delays in the review process and eventual acceptance. Where substantial particularities exist in local technical terms, the U.S. version will be used.

Authors are asked to submit manuscripts in digital version using MS Word format via e-mail to the Technical Editor, cdehoop@lsu.edu. E-mailing with read receipt is advised. Alternatively, a printed copy (do not staple) may be sent by regular mail to Dr. Cornelis F. de Hoop, *IJFE*, c/o Louisiana State University Ag Center, 227 Renewable Natural Resources Bldg., LSU Campus, Baton Rouge, LA 70803-6202 USA. If an electronic copy is submitted, there is normally no need to submit a printed version.

Manuscripts should be sent in at least two (2) files: the manuscript and an author file; because all manuscripts will be reviewed in a double-blind process.

The authors file should include title of paper, authors' names, job titles, affiliations, complete addresses of the affiliations, and e-mail addresses. Corresponding authors should take care to provide correct and complete name, position title, and affiliation information for all of the authors associated with the submitted manuscript. This information will be included in the published article to assist in the free exchange of ideas and comments related to material printed in the *IJFE*. If the paper describes work that was sponsored, acknowledge the sponsoring entity. If the paper includes an Acknowledgements section, it may be included with the authors file to facilitate blind review.

If submitting in paper format only, the title, authorships, and acknowledgements should be printed on a separate sheet of paper. Please repeat the title on the first page of the text.

The manuscript should be submitted in a separate file (s) (no authors), formatted as detailed, with the pages num-

bered consecutively and the lines on each page numbered. The title page should only include the title of the manuscript, which should be as concise as possible. This will facilitate the insertion of authorships in the final version.

Major headings should be in bold uppercase letters, left aligned, with secondary headings in bold lowercase letters also left aligned. Double spacing should be used throughout. An abstract of no more than 250 words must precede the main text. The abstract should contain the essence of the work. It should summarize why the work was done, what was done and how, and the results and conclusions. Be sure to include the major results and conclusions; this is a common deficit in first submissions. The abstract should be followed by up to 10 keywords, which will be used for indexing. Footnotes should not be used. SI units should be used, with English units in parentheses after each measure, if appropriate. All costs are to be translated into U.S. dollars using exchange rates current at the time of manuscript submission.

References should be listed alphabetically at the end of the manuscript in a "Literature Cited" section. If an author is repeated, the sequence is single author first, then two authors. References within the text should be cited in parentheses in chronological order at the appropriate location using the author-date style. For example, "... (Banks 1997, Adams and Jones 1998, Smith et al. 2000)." Use lowercase for periodical titles and uppercase for main words in book titles. Foreign titles should specify the language and be followed by the English translation in () and whether an English abstract is available. Accuracy and completeness are important. Do not abbreviate, and include specific volume and issue number when citing from journals.

Tables should be numbered consecutively and referenced in the text. Tables should be created in MS Word and included at the end of the manuscript. Tables should be kept simple and used for summary data, rather than raw data, if possible. Captions should be included above each table.

Figures, whether photographs, graphs, or diagrams, should be cited in the text and numbered consecutively. Figures should be prepared as black and white or grayscale images because the *IJFE* is not printed in color. In bar charts and pie charts, use various fill patterns rather than various grayscales. A brief descriptive legend should be included for each figure. Each figure should be included on a separate

page at the end of the manuscript. Figures are required in electronic form (jpeg, png, tiff, bitmap) when the manuscript is accepted for publication. High-resolution tiff files are preferred. If images were taken with a digital camera, save or export them to 300 dpi tiff files. If saving as a jpeg is the only option, be sure to use the least amount of compression (highest quality) setting. Lettering and line thickness should be chosen so that they are clearly legible and of consistent size when the figures are reduced for final printing. In line drawings, choose lines thick enough to withstand reduction. Do not choose the thinnest line weight available in your graphics program; hairline rules should not be used. For maximum clarity, lettering should be done in a standard sans serif font (e.g., Helvetica or Arial), and the Symbol font should be used for Greek, Latin, and other special characters. The style in figures should be consistent with the text, including capitalization and SI usage. Place units of measure for axis labels in parentheses after the label (e.g., Growth (%) not Percent growth). Keys to symbols, if needed, should be kept simple and be positioned so they do not needlessly enlarge the figure (i.e., placed inside the figure in an open area or placed underneath the x-axis label).

Where tree or other biological species is an important feature of the results of the paper, the Latin names (without authorities) should be included in the keywords. This will aid people searching for papers about forest operations with specific species or ecosystems. In addition, the keywords should include the country where the field work was conducted or to which the results apply.

Submission Guidelines for Articles Accepted for Publication

All submissions of modified manuscripts must include a description of how the reviewer's comments have been addressed. Cover letters should refer to the *IJFE*'s manuscript number. Once accepted for publication, the manuscript and accompanying figure files should be provided. The MS Word file should contain the manuscript, tables, and a list of figure captions.

Each figure should be included on a separate page at the end of the manuscript. For initial submissions, figures may be included as part of the MS Word file. However, figures in the final version should be submitted as separate files, where appropriate. Note details on figures, as described above, because quality problems with figures are common and sometimes frustrating.

Address for Correspondence about Manuscripts

Authors should correspond directly with the Technical Editor:

Dr. Cornelis F. de Hoop, Associate Professor
227 Renewable Natural Resources Building
LSU Campus
Baton Rouge, LA 70803-6202 USA
Tel: (225) 578-4242 Fax: (225) 578-4251
E-mail: cdehoop@Lsu.edu

Correspondence concerning managerial or subscription issues should be addressed to:

International Journal of Forest Engineering
Forest Products Society
2801 Marshall Ct.
Madison, WI 53705-2295
Telephone: (608) 231-1361

Copyright

Submission of a manuscript for publication implies that the work has not been published previously. If accepted for publication, the copyright will be transferred to the publisher for both the print and electronic versions. No material published in the *IJFE* may be reproduced, stored, or transmitted in any form or by any means without prior permission of the publisher. The *IJFE* will favorably entertain requests to reprint for educational use.

Claimed Issues Policy

All claims for missing issues must be made within 12 months of the publication date of the issue being claimed.

Reprint and Page Charge Policy

Senior authors will receive a pdf version of their printed paper. Manuscripts published in the *IJFE* are subject to a page charge of \$135 per printed page; \$155 per page if none of the first three authors is a Member of the Forest Products Society (FPS).

Subscription Prices

The *International Journal of Forest Engineering (IJFE)* is a semiannual publication. Members of the Forest Products Society may choose the *IJFE* as part of the benefits provided in their annual membership dues. Members may also choose to receive both the *IJFE* and the *Forest Products Journal* for an additional \$75 to be added to their current annual membership fee. The additional cost for FPS Student or Retired Members is \$45.

Nonmember subscription rates to the *IJFE* are: \$155 for addresses in the United States; \$165 for addresses in the Canada and Mexico; and \$195 for addresses in all other countries.

Online password-protected access to all editions of the *IJFE* is available for \$40 per year for individual subscribers. Institutions with printed subscriptions may purchase access for all computers within the institution's IP address range for \$125 per year. See <http://www.forestprod.org/ijfeonline.html>. If online access has been purchased, visit <http://journals.hil.unb.ca/index.php/IJFE> to view the articles (thanks to University of New Brunswick for maintaining the *IJFE* on their server!).

To subscribe to the *IJFE*, please contact the FPS Circulation Manager by phone at (608) 231-1361, ext. 201; by fax at (608) 231-2152, or by e-mail at membership@forestprod.org.