Thank you to the Organizers, Partners and Sponsors of the XXIV IUFRO World Congress.

IUFRO 2014 WORLD CONGRESS

SUSTAINING FORESTS, SUSTAINING PEOPLE: THE ROLE OF RESEARCH.

IUFRO

HOST

KEY PARTNERS

NAUFRP

Society of American Foresters National Convention Salt Lake City, Utah October 8-11, 2014

Canadian Institute of Forestry / Institut forestier du Canada

CONGRESS SPONSORS

esri

USDA

University of Idaho College of Natural Resources

TD

NASA

U.S. Department of the Interior Bureau of Land Management

ITTO

OSU Oregon State University College of Forestry

ArborGen

School of Environmental and Forest Sciences University of Washington College of the Environment

International Paper

CIFOR

Sustainable Forestry Initiative

BIFOR Birmingham Institute of Forest Research

MB&G Mason, Bruce & Girard, Inc.

iptim

American Forest Foundation We grow stewardship every day.

Weyerhaeuser

RMEF 1984 Celebrating 30 Years 2014

ALTA

Association of BC Forest Professionals

forests

Forest Biometrics Research Institute

GEICO

FFPRI Forestry and Forest Products Research Institute

The American Chestnut Foundation

Utah DNR Forestry

IUFRO-SPDC SPONSORS

CIFOR

Ministry for Foreign Affairs of Finland

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ITTO

KFRI 국립산림과학원 Korea Forest Research Institute

Ministerium für ein Lebenswertes Österreich

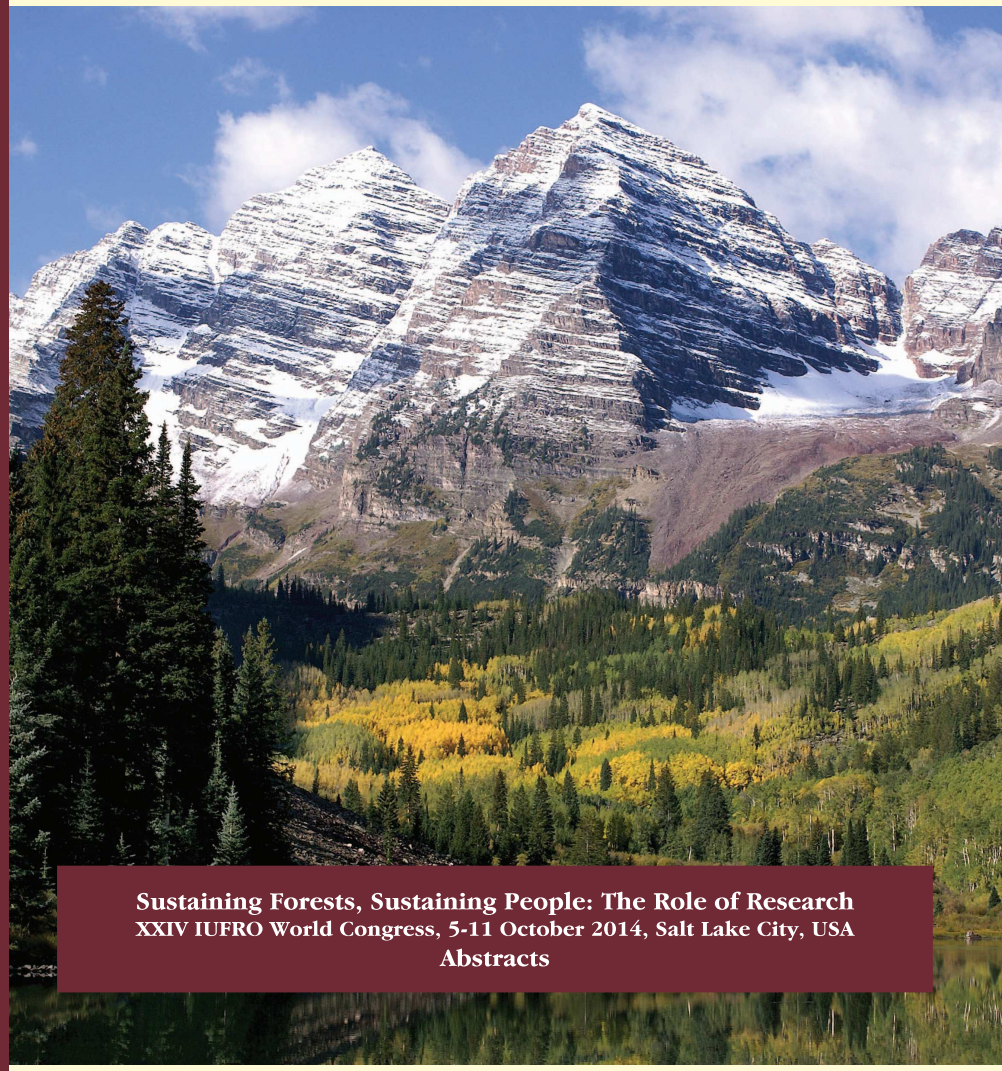
U.S. Department of Agriculture Forest Service

THE INTERNATIONAL FORESTRY REVIEW

XXIV IUFRO World Congress

Vol. 16 (5), 2014

The International Forestry Review



Sustaining Forests, Sustaining People: The Role of Research

XXIV IUFRO World Congress, 5-11 October 2014, Salt Lake City, USA

Abstracts

EDITORS: JOHN A. PARROTTA, CYNTHIA F. MOSER, AMY J. SCHERZER, NANCY E. KOERTH and DARYL R. LEDERLE

International Forestry Review (print) ISSN 1465-5498
International Forestry Review (online) ISSN 2053-7778

Vol.**16**(5), 2014

PUBLISHED BY THE COMMONWEALTH FORESTRY ASSOCIATION www.cfa-international.org

The International Forestry Review

Contact

The Editor, International Forestry Review,
The Crib, Dinchope, Shropshire SY7 9JJ, UK
Telephone: +44 (0)1588 672868
Email: cfa@cfa-international.org, Web: www.cfa-international.org

Cover photo: Maroon Bells, Aspen, Colorado, USA
Credit: Bernie "Shiloh" Parresol

GUIDELINES FOR AUTHORS

Please send the Abstract of the paper to the Editor at cfa@cfa-international.org. If it is considered suitable for consideration you will be asked to send the complete manuscript.
Manuscripts submitted for consideration must conform to the following points. Any deviation will result in the manuscript being returned to the author.

COMPOSITION
- Contributions must be original* and not have been submitted for publication elsewhere.
  (Note: Plagiarism is evaluated by use of electronic software. For more information on what constitutes plagiarism, and why it is important please click here).
- The text, excluding tables, references and appendices, should not exceed 7000 words, although exceptions may be permitted in special cases.
- A SUMMARY of not more than 150 words must be supplied, together with 5 keywords.
- All spelling must conform to UK/international English.
- The layout of the text and style of table and figure legends and references must conform to that of the International Forestry Review. This means:
  - Main title in Arial, Text in Times New Roman
  - The hierarchy of headings is: CAPITALS, **bold lower case**, *italics lower case*.

TEXT
- Manuscripts should be produced in Microsoft Word, written in Times New Roman typeface (size 12 pt), with single row spacing, left justification and without hyphenation.
- The manuscript should be written in the passive voice, e.g. 'The experiment was carried out' *is correct*; 'We carried out the experiment' *is incorrect*.
- Manuscripts should be submitted with UK English spellings. Make sure that a spell check with UK English spellings is used prior to submission.
- Paragraphs should not be separated by any additional line spacing. The first paragraph in a section should not be indented. The first line of each subsequent paragraph should be indented to 1.27cm.
- Use quotation marks (" ") only around quotations or titles. Do not use them to highlight or emphasise text.
- *et al.* is correct, et al is incorrect.
- The document should be saved as a Microsoft Word file with *.doc file extension.

TITLE
- The title and author's details should be in the following format

Mutually beneficial company-community partnership in ensuring its long-term viability: emerging lessons from Indonesia

A.A. NAWIR and L. SANTOSO

Center for International Forestry Research, Jl. CIFOR, Situ Gede, Sindang Barang, Bogor 16680, Indonesia

Email: a.nawir@cgiar.org and l.santoso@cgiar.org

TABLES
- Tables should clear and simple, with a maximum of 8 columns. (Note that tables have limited space in the final layout and therefore the reduction of font size to a minimum of 8 pt during typesetting should be taken into account when preparing tables).
- Headings and other texts in table cells should to be concise. Tables including captions, legends and footnotes should be written in Microsoft Word (in exceptional cases Microsoft Excel can be used following agreement of the Editor).
- Tables should be saved in a separate file (not as an integral part of manuscript) and the manuscript text should contain the reference to the position of the table (or figure) in brackets.

NUMBERS
- Numbers greater than 999 should be written with appropriate spaces and without commas, e.g 10 000 is correct, 10,000 and 10000 are incorrect

FOOTNOTES
- References to footnotes in the main text should be marked with arabic numerals in superscript form.

GRAPHS AND FIGURES
- Graphs, diagrams and other figures should be prepared in Microsoft Excel or in Microsoft PowerPoint and saved in separate files. Graphs and diagrams should be drawn in 2-D form (not in 3-D spatial form) and single columns or circle sectors (in case of pie diagrams) should be filled with graycscale colours (not with colour filling or by using of automatic hatching). The line weight of axes and other lines and also the size of used letters or numerals should be appropriate to the final size reduction of diagrams during layout of final magazine page (maximum width of finally reduced diagram is either 8 or 18 cm depending on whether it fits one or two columns).
- Complex images such as maps (drawn in line draw or grayscale format) should be prepared in one of the following: CorelDraw, Adobe Illustrator, Adobe Photoshop, Macromedia Freehand or similar in which he finished images can be saved as *.eps (Encapsulated PostScript) file format. B&W photographs should be submitted as *.tif image file format with a resolution of at least 300 dpi. Colour photographs may be submitted only after agreement with the Editor. Colour images should be saved in CMYK colour format, as *tif file format and with a resolution of at least 300 dpi.
- Titles should be in the format: TABLE X *Title of table*

SCIENTIFIC NAMES
- The complete scientific name (genus, species, authority and, where appropriate, cultivar) should be cited at the first occasion of its mention and written in italics (authority in normal type). If vernacular names are used, they must be accompanied by the correct scientific name at first use.

CITATIONS
- For text citations, papers should be referred to as (Smith 1998) and papers by the same author in the same year should be distinguished by lettering in sequence (1998a, 1998b, etc.). Where papers are written by a single author or two authors their names should be cited. If three or more authors are involved the first name should be listed followed by '*et al.*', e.g. (Smith *et al.* 2002).
- Citations should be separated by a comma, not a semi-colon, i.e. (Johnstone 2003, Smith 2002, Smith *et al.* 2002).
- Multiple citations by different authors should be listed alphabetically, e.g. (Brown 2001, Jones 2003 and Smith 2002).
- Multiple citations by the same author should conform to the following format (Brown 2001, 2005, 2009).

QUOTATIONS
- Direct quotations from papers or books should be referenced in the format (Smith 1998: 23-24).

REFERENCES
- At the end of the paper, the list of references must be arranged in alphabetical ordering without serial numbering.
- References should be formatted with a ‚hanging' indent.
- There should be no additional line spacing between individual references.
- The following standard forms of citation must be used:
  Author's name, all authors' initials to follow surname, journal and book titles in italics. Volume number in bold. Second and subsequent lines should not be indented. For example:

  Journal paper
  LÄHDE, E., LAIHO, O., NOROKORPI, Y. and SAKSA, T. 1999. Stand structure as the basis of diversity index. *Forest Ecology and Management* **115** (2/3): 213-220.

  Paper or chapter in proceedings
  SMITH, W.J. 2001. Selection of tree species for arid environments. In: BLACKBURN, J.W. (ed.) *Multipurpose trees and shrubs for fuelwood and agroforestry*. CNRD Monograph No4. 366 pp.

  Book
  PHILLIP, M.S. 1994. *Measuring trees and forests*. 2nd edition, CAB International, Wallingford, England. 310 pp.

- Unnecessary use of capitals should be avoided. For example
  HOLMGREN, J., JOYCE, S., NILSSON, M. and OLSSON. H. 2000. Estimating Stem Volume and Basal Area in Forest Compartments by Combining Satellite Image Data with Field Data. *Scandinavian Journal of Forest Research* 15: 103–111. Is incorrect.
  HOLMGREN, J., JOYCE, S., NILSSON, M. and OLSSON. H. 2000. Estimating stem volume and basal area in forest compartments by combining satellite image data with field data. *Scandinavian Journal of Forest Research* 15: 103–111. Is correct.
- Websites should only be quoted in isolation where hard copies are not available.

ACKNOWELDGEMENT
- It is necessary for authors to acknowledge suggestions made by referees with a simple statement such as 'The valuable suggestions made by anonymous referees is gratefully acknowledged'.

SUBMISSION
- Manuscripts offered for publication should be submitted by email to cfa@cfa-international.org

REFEREEING
- Contributions will be referred to at least two expert referees. Authors will be consulted if the paper is considered suitable but alterations are thought desirable. After alterations have been agreed and incorporated, the paper will be considered final.

ASSISTANCE WITH PUBLICATION
- For assistance with preparing manuscripts visit our **Online guide to scientific writing** at www.cfa-international.org/OGSWintro.html

* Original means that the paper, or any close derivative of it, has not been published previously in any form, including on the internet.

The International Forestry Review

Sustaining Forests, Sustaining People: The Role of Research

XXIV IUFRO World Congress, 5–11 October 2014, Salt Lake City, USA

Abstracts

EDITORS

JOHN A. PARROTTA, CYNTHIA F. MOSER, AMY J. SCHERZER,

NANCY E. KOERTH and DARYL R. LEDERLE

Environmental responses and biophysical controls over transpiration by stands/trees subject to urban, suburban, and semi-arid environmental conditions. Chen, L., Zhang, Z. (*Beijing Forestry University, China; myclover17@gmail.com; 122283586@qq.com*).

The objective of this study was to compare the transpiration (E_c) responses to environmental factors under urban and natural conditions. Therefore, our study adopted Granier-type probes to monitor stand/tree transpiration in urban, suburban, and semi-arid natural conditions. We found isohydraulic control over transpiration across species based on the fact that species observed the 0.6 ratio between the sensitivity of canopy conductance to *VPD* and reference G_c under all environmental settings. Therefore, E_c can be estimated reliably based on the accurate canopy conductance measurement under 1 kPa and concurrent meteorological data. But species differences can not be obscured. Trees under urban conditions tended to have stronger transpiration coupling with the atmosphere. Different from those growing in urban and suburban surroundings, trees in a semi-arid environment failed to maintain E_{cmax} when stressed by high *VPD*. No significant decrease was observed for trees during the rainless intervals under all environment conditions. But unlike in semi-arid environment, transpiration of trees in urban and suburban surroundings grew with frequent large rainfall (>30 mm/event). Post-rainfall transpiration recovery results indicate that changes of the rainfall characteristics (scale and frequency) will lead to variation of vegetation cover under natural conditions.

The season, severity, and frequency of prescribed fire shaping the community dynamics of heathland shrub species. Chick, M., Cohn, J., Nitschke, C., York, A. (*University of Melbourne, Australia; mchick@student.unimelb.edu.au; janet.cohn@unimelb.edu.au; craign@unimelb.edu.au; alan.york@unimelb.edu.au*).

Throughout the fire prone regions of the world, the threat of wildfire is being met through increasing both the temporal and spatial components of prescribed burning, meaning the frequency is increasing and the seasonality and severity are altered. Within Victoria, Australia, fire management practices are such that fire prone communities, such as heathland, will experience prescribed burning across a larger range of age classes and at higher frequencies into the future. This research will be focusing on the ecological responses of shrubs in the heathland community to time since last fire (TSLF), the season (spring versus autumn) and severity of prescribed fire, and how these responses vary geographically across a precipitation gradient. This will occur retrospectively through the assessment of TSLF shrub species dynamics, presently through building predictions of community responses when prescribed fire is introduced into these different TSLF dynamics, and into the future through modeling community responses to alternate seasons of prescribed fires with the use of fire scenario modeling. To obtain these objectives, data collected will parameterize the landscape dynamics model LANDIS-ii. Through this research better understanding of the relationship between climate, fire regimes, and shrub dynamics in heathland will be developed.

Stand transpiration estimated by sap flow measurements in a mixed broadleaved forest, western Japan. Chiu, C. (*Kyushu University, Japan; ccwei97@gmail.com*), Komatsu, H. (*Kyoto University, Japan; kmthkr@gmail.com*), Kume, T. (*National Taiwan University, China-Taipei; kumett@ntu.edu.tw*), Otsuki, K. (*Kyushu University, Japan; otsuki@forest.kyushu-u.ac.jp*).

The amount of water used by trees has been widely researched for more than 100 years, and several studies have mentioned that forest types can affect the hydrological cycle of watersheds. Now more than 45% of the forest area in Japan is covered by natural broadleaved forests and most of them consist of mixed forests. However, rare studies have examined variations in sap flow among different types of forests which prevented researchers from estimating canopy transpiration on the basis of the sap-flow method. As a starting point to establishing a method to estimate canopy transpiration based on tree transpiration measurements on the basis of the sap-flux method, we evaluated stand transpiration of a temperate mixed broadleaved forest in Kyushu Island, western Japan. On the other hand, from the viewpoint of water resource management, it is commonly believed that conifer forests have relative higher annual evapotranspiration than broadleaved forests in Japan. To confirm this assumption, we will use data from previous studies which have estimated transpiration of a conifer forest near our study site to compare with our data.

Insect diversity and conservation of Nurod Urod Forest Reserve in Sabah, Malaysia. Chung, Y., Ibrahim, N., Richard, M., Yukang, J., Reuben, N. (*Sabah Forestry Department, Malaysia; arthur.chung@sabah.gov.my; nurulaqidah.ibrahim@sabah.gov.my; richard.majapun@sabah.gov.my; John.Lee@sabah.gov.my; reuben.nilus@sabah.gov.my*).

An insect diversity survey was carried out in June 2012 in Nurod Urod Forest Reserve. Located at the southern part of the Malaysian Sabah in Borneo, the upland mixed dipterocarp forest covers an area of 1 705 hectares. Nocturnal insect diversity was moderately high when compared to other forest reserves surveyed in the past. The Bornean endemics recorded during the survey were four moth species and two damselfly species, namely *Adites hosei, Amata egenaria, Auriculoceryx pterodactyliformis,* and *Lygniodes schoenbergi* (moths); *Rhinocypha aurofulgens* and *Rhinagrion elopurae* (damselflies). As no other insect survey has been conducted in this forest reserve in the past, this pioneer data serves as baseline information for future research work. The endemic, rare, and interesting insect species recorded during the survey provide salient information to enhance the conservation of this forest reserve as well as to provide input for the preparation of a forest management plan. Threats and recommendations to enhance the biodiversity are also discussed.

Climate signals derived from day-to-day analysis: climate sensitivity of *Picea abies* in Northern Italy (Trentino, Eastern Alps). Cocozza, C., Palombo, C (*University of Molise, Italy; claudia.cocozza@unimol.it; caterina.palombo@unimol.it*), Anichini, M. (*Trees and Timber Institute (IVALSA), Italy; anichini@ivalsa.cnr.it*), Tognetti, R. (*University of Molise, Italy; tognetti@unimol.it*), Giovannelli, A. (*Trees and Timber Institute (IVALSA), Italy; giovannelli@ivalsa.cnr.it*), La Porta, N., Emiliano, G.

The intra-annual dynamics of wood formation were used to describe seasonal changes in xylem differentiation phases and to calculate the timing of cell development in Norway spruce (*Picea abies* (L.) Karst.). Tree-ring dynamics of Norway spruce from two altitudinal limits were studied to detect climate signals in the day-to-day dynamics of wood formation. The investigation was conducted during the years 2011–2012 in Trentino-South Tyrol (eastern Italian Alps), in two sites, Savignano (650 m a.s.l.) and Lavazè (1800 m a.s.l.). The climate is subalpine-continental type with a solstitial pluvial curve (maximum values in summer and minimum values in winter). Dendroclimatological analysis was performed to examine the relationship between the tree rings formation of Norway spruce and climatic parameters in the study sites. Climate–growth relationships were analyzed using

correlation function (CF) analysis and moving CF (MCF), detecting correlations between wood formation and seasonal patterns of temperature and precipitation. During the monitored years, the effects of climatic variables on cell structure and stem diameter variation were examined daily. Cell structure was investigated through microscope analysis, and stem diameter variation was detected with microdendrometers. The results were interpreted according to dynamics of forest vegetation and synchronicity of cambial activity.

Saproxylic Diptera biodiversity and intensive biomass harvesting. What are the implications of a damaged deadwood profile? Deady, R., Work, T. (*Université de Québec à Montréal, Canada; mycetophilid@gmail.com; work.timothy@uqam.ca*), Venier, L. (*Canadian Forest Service, Canada; lisa.venier@nrcan-rncan.gc.ca*).

Residual forest biomass in the form of fine and coarse woody debris continues to be proposed as a sustainable source of energy that will reduce dependence on fossil fuels. Biomass harvesting drastically transforms the deadwood profile. Saproxylic Diptera (true flies) like the Sciaroidea is likely affected by changes in deadwood and fungal communities. We will compare saproxylic Diptera assemblages in coarse woody debris (CWD), fine woody debris (FWD), and stumps using emergence traps. We will use Dipteran assemblage differences to: (1) assess whether per unit volume FWD of Jack pine (*Pinus banksiana*) wood is more conducive to speciose and abundant communities than CWD; (2) test how intra-log CWD variation affects saproxylic Diptera assemblages; and (3) examine whether residual stumps act as persistent refuges for biodiversity after removal of biomass. Approx. 500 Sciaridae specimens have been identified to date of 40 species. Preliminary ordinations and GLMs show a slight though significant demarcation between advanced decay assemblages versus early decay assemblages, which may be more apparent with more sampling. Diameter appears to be an important variable despite using provisional data. We are using this information to quantify thresholds of deadwood retention under biomass harvesting and integrating Sciaroid biology into applied forest management.

Response of ground-beetle (Carabidae) assemblages to harvest and wildfire in lodgepole pine forests of western Alberta, Canada. Del Bel Belluz, V., Spence, J. (*University of Alberta, Canada; vbelluz@gmail.com; jspence@ualberta.ca*), Langor, D. (*Canadian Forest Service, Canada; david.langor@nrcan-rncan.gc.ca*).

Ground-beetle assemblages that occupy forests regenerating after harvest differ between stands of various age classes. Such differences have been attributed to differential habitat preferences, and species have been categorized as generalists and specialists in both open-habitat and mature forest. This study explores how assemblages have changed in lodgepole forests near Hinton, Alberta up to c. 60 years post-harvest, and explores potential differences between assemblages from forests regenerating, respectively, after fire and harvest disturbance. Results will increase the understanding of how effects of human harvest may change beetle assemblages in Albertan forests as compared to the natural disturbance of wildfire.

The influence of thinning on tree-water relations in an Aleppo pine forest in Valencia, Spain. Del Campo, A. (*Universidad Politécnica de Valencia, Spain; ancamga@upv.es*), Fernandes, T. (*Federal University of Acre, Brazil; tjgfernandes@yahoo.com.br*), Molina, A. (*Institute of Agrifood Research and Technology, Spain; amolihe@gmail.com*), Herrera, R. (*Venezuelan Institute for Scientific Research (IVIC), Spain; potoy@hotmail.com*).

Thinning of trees may be useful to improve growth rates and to change water fluxes, which are desirable outcomes when managing forests in semiarid water-limited environments. In these conditions, the need to implement proactive adaptive silviculture is widely recognized. The effect of thinning on tree-water relationships (transpiration and soil water content) and growth (basal area increment (BAI), determined through dendrochronological procedures) was investigated in 55-year-old Aleppo pine trees thinned at three different intensities plus a control. Tree growth was significantly enhanced after thinning, with an annual BAI four-fold that of the pre-thinning value and a lower dependence of growth on climate fluctuations (rainfall variability). The sap flow velocity (v_s) in thinned and control trees revealed different functionality of the sapwood. Higher values of v_s (3.59 cm/h) were observed in the thinned trees due to the improved soil water content, whereas it dropped off much more rapidly in the control trees due to lower functionality of sapwood (poorer site conditions). Tree transpiration in the study year reached 6 768 litres per tree in the heaviest intensity thinning. Combined dendrochronology and hydrology methods have proven to be useful in the study of the effects of hydrology-adaptive silviculture in semiarid Mediterranean forests.

Eddy-covariance-based estimates of carbon balance in two tropical seasonal forests in Thailand. Diloksumpun, S. (*Kasetsart University, Thailand; sapit.d@ku.ac.th*), Panuthai, S. (*Department of National Parks, Wildlife and Plant Conservation, Thailand; newsam@3bbmail.com*), Suansawan, C. (*Kasetsart University, Thailand; chatuphon_32@hotmail.com*).

The eddy covariance technique ascertains the exchange rate of CO_2 across the interface between the atmosphere and a plant canopy by measuring the covariance fluctuations between vertical wind velocity and CO_2 mixing ratio. Meteorological parameters were also measured for understanding the environmental conditions for ecosystem carbon cycle. To compare carbon balance of two contrasting tropical forests in Thailand, dry evergreen (DEF) and deciduous (DF) forests, net ecosystem exchange (NEE) was estimated and the choice of a friction velocity (u^*) correction for the estimation of flux on calm nights and other corrections were applied for data quality control. The change in NEE as a function of the u^* threshold was marked, and some of the measured nocturnal data were eliminated by using the 0.4 and 0.25 m/s u^* threshold for DEF and DF respectively. Data gaps were filled with linear interpolation, mean diurnal variation, and nonlinear correlation with temperature and photosynthetically flux density. The seasonal pattern of CO_2 exchange and effects of its factors was evident. The 2-year mean annual NEE from 2010 to 2011 was −2.68 and −3.62 Mg C/ha/yr respectively, reflecting differences in carbon gain in these two forests.

Mammal trade for zootherapeutic and mythic purposes in Benin (West Africa): capitalizing species involved, provision sources, and implications for conservation. Djagoun, C. (*Laboratory of Applied Ecology, Benin; sylvestrechabi@gmail.com*), Akpona, A. (*General Directorate of Forestry and Natural Resources, Benin; akpona@gmail.com*), Mensah, G. (*National Institute of Agricultural Research of Benin (INRAB), Benin; mensahga@gmail.com*), Nuttman, C. (*Topical Biology Association, United Kingdom; cvn22@cam.ac.uk*).