8th WORLD BAMBOO CONGRESS PROCEEDINGS 16-19 September 2009



NUMBER ONE Volumes 1 -11



WORLDBAMBOO.NET WORLDBAMBOOCONGRESS.ORG

Copyright 2009 World Bamboo Organization. All rights reserved.

ISSN 2150-1165 (CD ROM)





8th World Bamboo Congress Proceedings (ISSN 2150-1165) is a publication of the World Bamboo Organization headquartered in Massachusetts, U.S.A. Email: lucas@worldbamboocongress.org

World Bamboo Organization and 8th World Bamboo Congress are not responsible for statements and opinions published in the Official Proceedings, 8th World Bamboo Congress; they represent the views of the authors or persons to whom they are credited and are not necessarily those of the Organization. The publication of research or other types of information by the Organization does not constitute a recommendation or endorsement of products or procedures involved.

Reprinting and quotations from the 8th World Bamboo Congress Proceedings are permitted only on the conditions that full credit is given to both the 8th World Bamboo Congress Proceedings and written approval is obtained from the author(s). In addition, the volume, pagination, and date of publication must be indicated.

#### Acknowledgements

The editors are indebted to several groups and individuals whose special contributions have enriched these Proceedings, published electronically as Number One, the first published World Bamboo Congress Proceedings by the World Bamboo Organization. Throughout this project, the continued encouragement of Kamesh Salam, President of the WBO, and Walter Liese, bamboo scholar and genuine friend, provided the incentive to make this event a reality.

This publication of the 8th World Bamboo Congress Proceedings would not have happened without the dedication of WBO's colleagues, Watershed Media, to whom editor Susanne Lucas is eternally grateful.

We hereby acknowledge and thank the following supporters:

Equinox Marketing Ltd. **Royal Forest Department** Kasetsart University Thailand's Ministry of Natural Resources and Environment Thailand's Department of Environmental Quality Promotion Thailand's Department of National Parks, Wildlife and Plant Conservation Thailand's Department of Agricultural Extension Thailand's Department of Export Promotion Thailand Convention and Exhibition Bureau Thai Air Jet Airways UNIDO International Network of Bamboo and Rattan Association of Southeast Asian Nations National Bamboo Mission, Ministry of Agriculture, India Cane and Bamboo Technology Centre Bamboo Society of Australia Japan Bamboo Society Japan Bamboo Association Thailand Mr. Yves Crouzet Touchwood Limited

Copyright 2009 World Bamboo Organization. All rights reserved. ISSN 2150-1165 (CD ROM)



















\* BALADAD SOCIETY





## Foreward

The World Bamboo Organization (WBO) is proud to present the VIII World Bamboo Congress following the VII WBC in New Delhi, India in 2004. After the cancellation of the proposed congress in Brazil in 2007, it has been a challenge for the WBO to organize this congress in Bangkok. The recent global financial meltdown is indeed an important wake-up call for the world economy. It is more than evident today that economic growth and sustainable development is not necessarily the same thing. During the last century and a half, the industrial revolution has witnessed unprecedented material development. However, such material development has come at a significant cost. Even as societies grapple with these challenges, the world today is confronted with another impending catastrophe: the phenomenon of global warming and climate change. As such, this edition of the World Bamboo Congress in Thailand has rightly chosen the theme of "*Bamboo, the Environment and Climate Change.*"

It is a privilege for WBO to associate with the people of Thailand in hosting the VIII World Bamboo Congress; importantly also that the event coincides with the 113<sup>th</sup> Anniversary of Thailand's Royal Forest Department on September 18. This day will also be important to all the bamboo lovers as it also will be declared as "World Bamboo Day"!

Bamboo is so tightly interwoven in the life of the Asian people that it is hard to imagine Asian culture without bamboo. It has now gained acceptance globally in light that it is a versatile plant which holds many promises for the both rich and poor nations. The theme of the congress – "Bamboo, the Environment and Climate Change" is a theme of global relevance as climate change is a immense challenge which needs urgent response and action. It is very encouraging to know that the global community of bamboo experts and researchers are working on the most pressing issue of the time.

The vital issue here is: how can bamboo help us do things differently? Or what can we do with bamboo that will benefit the environment, our world, and ultimately, our lives? I am sure that this bamboo congress will offer many new perspectives to address this question. It is inspiring to know that the program of this congress includes a plethora of topics covering biology, engineering, architecture, industrial applications and development of community and economy.

As a Foreward to this bamboo congress, I would like to give my perspective on the issue of bamboo within the context of global environmental concerns without excluding the concern for achieving economic development and sustainability. Developing countries that are heavily reliant on agriculture are the most vulnerable to changes in climate. Global actions and responses to address climate change need to be made on the basis of the principles of equity, flexibility, effectiveness and common but differentiated responsibilities. Alternately, environmental policies – particularly strategies for tackling climate change - have to consider the relative

economic conditions of countries and respective capacities of their people. The priority we give to the environment must be balanced with the need of the country to achieve sustainable development.

Considering the alarming rate of deforestation in the world, it is clear that we are compromising the ability of future generations to meet their needs and thereby constrain their possibility to consume timber products. Trees are crucial for the global environment as they absorb carbon dioxide; they are important instruments to minimize global warming and related problems. It is for this reason that it has become important to find an alternative to wood. Here, bamboo has the advantage of growing fast and being a perfect material for a wide application of industrial products. By using fast growing alternative and renewable resources such as bamboo, we can reduce the pressure on tree forests, safeguarding the natural environment and the needs of future generations.

From a social perspective, bamboo is a great source for productive employment especially in rural areas facing unemployment problems. Bamboo can not only generate sustainable livelihood for the rural poor but will also give them a sense of identity and a meaning to their life.

Therefore the potential advantage of bamboo for environmental and economic development cannot be understated. However, to realize the potential of bamboo, interventions are needed, particularly in the field of forestry and land use, industry, technology and finance.

I am confident that this VIII World Bamboo Congress, attended by delegates and participants from more than 30 countries, will generate many new ideas that will stimulate economic development through bamboo for the sake of the environment and livelihood development.

I am also thankful to the sponsors of this Congress, particularly the National Bamboo Mission of India, the Government of Nagaland, India, Building Materials and Technology Promotion Council (BMTPC), The Japan Foundation, Japan Bamboo Society, Bamboo Society of Australia, ASEAN Secretariat, the Royal Forest Department of Thailand, Kasesart University Bangkok, UNIDO, FAO, TCEB, and Royal Thai Airways, for their support to this Congress.

Finally, I would like to thank Ms. Susanne Lucas, Organizing Chair Person of this Congress, Mr. Harsh Adhyapak, Event Co-Ordinator, Professor Dr. Walter Liese, Mr. M. Rajaretnam of ASEAN, and Mr. Smit Boonsermsuk of RFD Thailand and my colleagues at CBTC for their continued commitment and support in organizing this historic event in Bangkok, Thailand.

(KAMESH SALAM)

President, WBO

### From the office of the World Bamboo Organization

# A letter of introduction to our bamboo friends around the world, with our greatest respect:

The World Bamboo Organization (WBO) is dedicated to promoting the use of bamboo and bamboo products for the sake of the environment and the economy. We play a crucial networking role by connecting people for useful collaborations on all things related to bamboo.

We are very excited by the great opportunity to organize the VIII World Bamboo Congress in Thailand 16-19 September, 2009, which coincides with the 113<sup>th</sup> Anniversary of the Royal Forest Department on the 18<sup>th</sup> of September.

This truly unique conference is the culmination of our efforts to physically unite bamboo enthusiasts and professionals from all over the world and especially throughout Thailand and south-east Asia. Since its inception in Puerto Rico in 1984, each World Bamboo Congress has convened a vast array of individuals, institutions, businesses, and decision makers, and has created new partnerships that have made a real difference for the environment and human communities around the world. The WBC in Thailand promises to be the most ambitious international bamboo event ever. It will be uniquely informative, educational, culturally and intellectually challenging. The event will highlight the state-of-the-art in bamboo science, technology and industry. It will be a forum to stimulate the dialog between researchers, entrepreneurs, industrialists, ecologists, and policy makers. It will help bridge the gap between supply and demand, need and fulfillment, producer and consumer, problem and solution.

As we all know, the world suffers amidst a difficult economic downturn, yet we must continue to work together to mend environmental degradation and improve networking to insure a better future for people and for bamboo. The cancellation of the planned VIII WBC to be held in Rio de Janeiro in 2007 was not just a huge disappointment, but also proof that the bamboo community needs serious attention. Failure to capture sufficient funding means countries - not only corporate businesses - involved in bamboo business get left behind in the competition for a piece of the global market.

Therefore, we emphasize that <u>this World Bamboo Congress is a true collaboration</u> of all entities serious about elevating the great potential of bamboo, those who believe it to be a real answer to the world's current environmental challenges and economic necessities. We thank you in advance for joining our efforts for bamboo and being a significant part of the VIII WBC.

Sincerely,

Susanne Wees

Susanne Lucas, Chief Executive Officer, WBO

Kamesh Salam, President, WBO

#### **Our History:**

**2004 World Bamboo Congress** India / Host: Government of India

**1998 International Bamboo Congress & Workshop** Costa Rica / Host: Fundacion Bambu

**1995 International Bamboo Congress & Workshop** Indonesia / Host: Environmental Bamboo Foundation

**1992 International Bamboo Congress** Japan / Host: National Government of Japan

**1991 International Bamboo Workshop** Thailand / Host: INBAR

**1988 International Bamboo Congress** France / Host: European Bamboo Society

**1984 International Bamboo Congress** Puerto Rico / Host: American Bamboo Society



The WBO is a non-profit trade association (501-c6) formed to facilitate the exchange of information from around the world on the environmental, socioeconomic, biological, and cultural aspects of bamboo. By bringing together local and regional bamboo people and creating mechanisms for global communications, the WBO's goal is to facilitate the development of new partnerships and alliances to advance the causes of bamboo and furthering the efforts of bamboo practitioners worldwide.

Headquarters: World Bamboo Organization, 9 Bloody Pond Rd., Plymouth, MA 02360 USA

www.worldbamboo.net / www.worldbamboocongress.org

VOL. 1	Inaugural Session
VOL. 2	Bamboo for Thailand and Southeast Asia
VOL. 3	Bamboo and the Environment
VOL. 4	Resources - Forestry, Plantations and Conservation
VOL. 5	Biology and Taxonomy
VOL. 6	Horticulture
VOL. 7	Community and Economic Development
VOL. 8	Production, Design and Industrial Aspects
VOL. 9	Material Properties
VOL. 10	Architecture and Engineering
VOL. 11	In Partnership for a Better World (INBAR)
	List of Authors