Bamboo,
a Sustainable Solution for Western Europe
Design Cases, LCAs and Land-use

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Pablo van der Lugt
Joost Vogtländer
Han Brezet

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Foreword

The need for sustainable development becomes urgently evident. This is caused by our continuously increasing consumption levels, resulting in a rising pressure on our global resources, and visible through the various financial, food and climate crises around the world. At the supply side, the use of fast growing sustainably produced renewable materials such as bamboo can help to meet this increasing demand.
Life Cycle Assessment (LCA) is used in this report to compare the environmental impact of bamboo materials in Western Europe with commonly used materials such as timber.

This is partly an updated version of the environmental assessments made in the PhD thesis "Design Interventions for Stimulating Bamboo Commercialization"[1] by Pablo van der Lugt. The thesis was written as part of the Design for Sustainability Program at the Faculty of Industrial Design Engineering at Delft University of Technology in the Netherlands. The work was supervised by Prof. dr. Han Brezet, while the environmental assessments were executed in close collaboration with Dr. Joost Vogtländer.
The data used in this report are slightly modified compared to the eco-costs calculations executed in the PhD thesis. The new data are based on the latest updates of the IDEMAT-2008 and Ecoinvent-V2 databases, from which the eco-costs/kg from the material alternatives have been derived.
Furthermore, some additional modified wood alternatives (Plato® wood and Accoya®) were added to the environmental assessment for the functional unit "terrace decking" in Section 2.6.

The report is targeted towards any stakeholder in the bamboo or wood production chain that wants to get a better understanding of the environmental sustainability of bamboo materials compared to alternatives. The environmental assessment also provides insight in the impact of each step in the production process on the overall environmental sustainability of a material. As a result, the supplier of the bamboo materials assessed, Moso International BV, has improved the production process of several of their bamboo materials (for details see Section 2.3).

Chapter 1 sketches the rationale of this research, providing the importance of sustainable development, the impact of materials on the environmental sustainability and the potential of renewable materials - and in particular bamboo - for sustainable development, leading to the objective of this report: to assess the environmental

[1] Available via http://www.vssd.nl/hlf/m015.htm and most (online) bookstores (ISBN 978-90-5155-047-4), or downloadable via http://www.library.tudelft.nl/ws/search/publications/search/metadata/index.htm?docname=381757

sustainability of bamboo materials in Western Europe compared to alternative materials. Chapter 2 provides the results of the environmental assessment in so called "Eco-costs" based on the negative environmental effects caused during the production of bamboo materials. Since the regenerative power of renewable materials is also an important environmental sustainability criterion which is not included in the LCA-based Eco-costs model, in chapter 3 the annual yield of bamboo materials is compared with several timber alternatives. Chapter 4 combines the results of chapter 2 and 3 to come to an overall conclusion about the environmental sustainability of bamboo materials based on current use in Western Europe, current use in the bamboo producing countries themselves and the future use of bamboo materials. Finally, in chapter 5, several recommendations are provided for further research as well as practical recommendations to the bamboo industry how to improve the environmental sustainability of their materials.

At this particular place I would like to thank director René Zaal of Moso International for the support and transparency in providing accurate production data which facilitated a comprehensive and complete assessment of the various bamboo materials. Furthermore I would like to thank my co-authors Dr. Joost Vogtländer and Prof. dr. Han Brezet for their support during my research process as well as in writing this report.

I sincerely hope that this report helps to further increase knowledge amongst stakeholders in the bamboo industry that bamboo materials are not always - as often unfoundedly claimed - the best environmental benign alternative around. This is only the case when several parameters, as presented in this report, are met, which may help shape policy objectives and suggestions for production improvements in the bamboo industry. May this report serve as a stepping stone toward this goal.

Delft University of Technology, The Netherlands, March 2009
Pablo van der Lugt
Joost Vogtländer
Han Brezet

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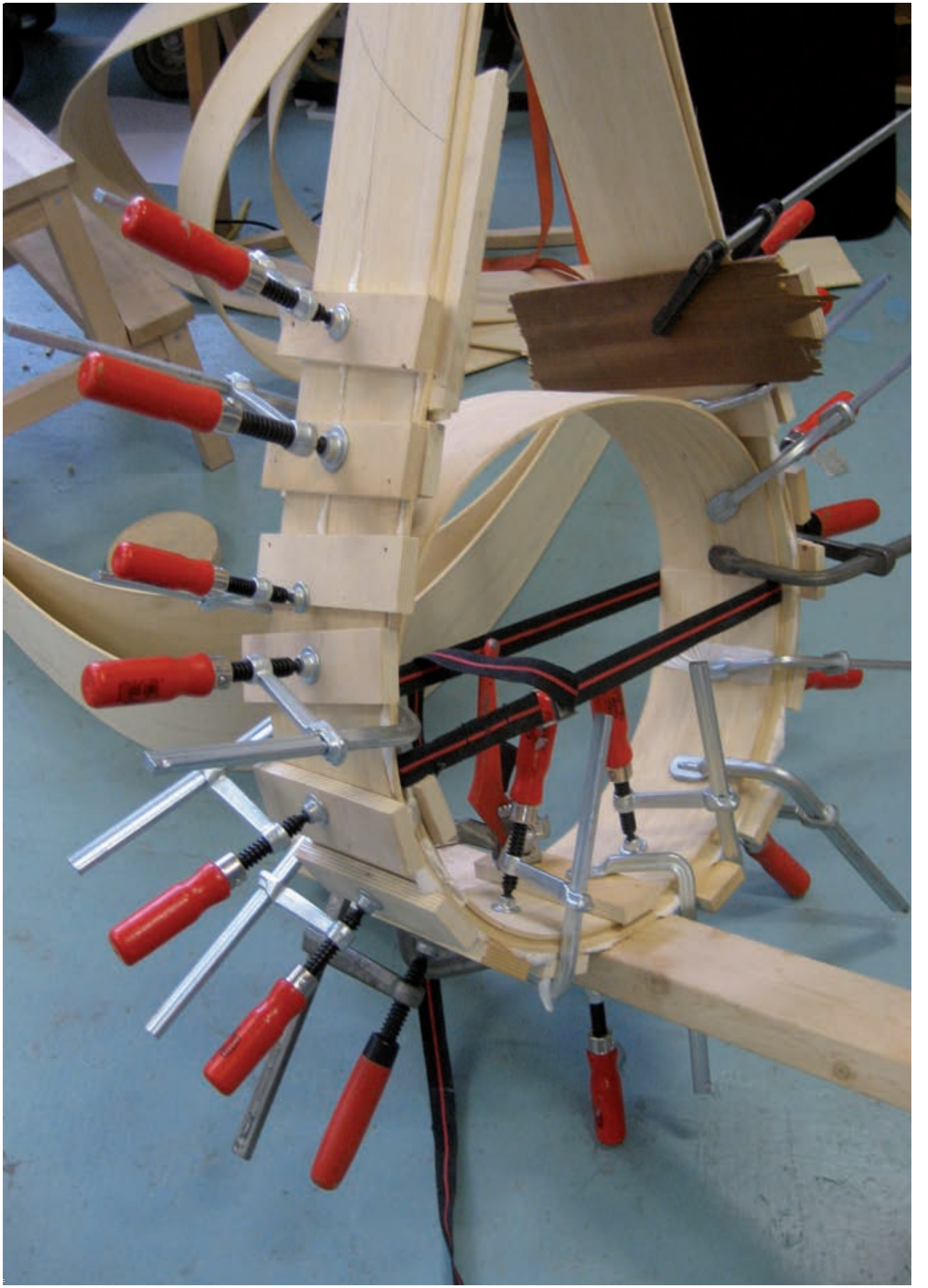

1 Introduction

1.1 Sustainable Development

Because of the growing human population on our planet in combination with an increase of consumption per capita, more and more pressure is put on global resources, causing the three main interrelated environmental problems: depletion of resources, deterioration of ecosystems and deterioration of human health, and their effects (see Table 1.1). Starting in the 1970s through the alarming warning from the Club of Rome, public awareness about the environment has increased drastically over the last decades. In 1987 the World Commission on Environment and Development headed by Brundtland presented the report Our Common Future (Brundtland et al. 1987) including the - now widely adopted - concept of sustainable development: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Although the report also emphasized the importance of decreasing the differences in wealth between developed countries in the "North" and developing countries in the "South", through a better balance in economy and ecology, the term "sustainability" was first mostly interpreted in its environmental meaning.

Depletion of resources	Deterioration of ecosystems	Deterioration of human health
Exhaustion of raw materials	Climate change	Ozone at living level
Exhaustion of fossil fuels	Erosion	Summer smog
Exhaustion of food & water	Landscape deterioration	Winter smog
	Desiccation	Noise hindrance
	Ozone layer deterioration	Stench hindrance
	Acidification	Light hindrance
	Nuclear accidents	Indoor pollution
	Eutrofication	Radiation
	Hazardous pollution spread	Spread of dust

Table 1.1: The three main environmental problems including their effects (adapted after van den Dobbelsteen 2004)

Resource	Fossil fuel reserves left based on most optimistic estimates (production years to go before depletion)
Oil	45 years
Gas	72 years
Coal	252 years

Table 1.2: Depletion of resources - consumption and reserves of fossil energy (EIA 2007)

The Brundtland Commission also introduced the factor thinking linked to the idea of sustainable development: to give future generations the same opportunities as mankind