

Eco-Architecture

Harmonisation between Architecture and Nature

WIT*PRESS*

WIT Press publishes leading books in Science and Technology.

Visit our website for the current list of titles.

www.witpress.com

WIT*eLibrary*

Home of the Transactions of the Wessex Institute.

Papers presented at Eco-Architecture I are archived in the WIT eLibrary in volume 86 of WIT Transactions on The Built Environment (ISSN 1743-3509).

The WIT eLibrary provides the international scientific community with immediate and permanent access to individual papers presented at WIT conferences.

<http://library.witpress.com>

FIRST INTERNATIONAL CONFERENCE ON
HARMONISATION BETWEEN ARCHITECTURE AND NATURE

ECO-ARCHITECTURE

CONFERENCE CHAIRMEN

G. Broadbent

University of Portsmouth, UK

C. A. Brebbia

Wessex Institute of Technology, UK

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

S. Badanes	M. L. Garrison	N. Sala
M. A. Baez	M. Hejazi	D. Sheppard
N. Baker	B. A. Kazimee	E. Stach
R. Borges	D. Lewis	W. Timmermans
D. Bosia	G. Manioglu	J. Tomlow
P. Brimblecombe	A. Marcomini	T. J. Truesdale
E. Constanzo	R. Pulsell	A. van Timmeren
E. Cullinan	S. Roaf	K. Yeang
J. M. de Bottom	G. Rosenhouse	R. Zmeureanu

Organised by

Wessex Institute of Technology, UK

In Collaboration with

International Journal of Ecodynamics

Sponsored by

WIT Transactions on Ecology and the Environment

Transactions Editor

Carlos Brebbia
Wessex Institute of Technology
Ashurst Lodge, Ashurst
Southampton SO40 7AA, UK
Email: carlos@wessex.ac.uk

WIT Transactions on The Built Environment

Editorial Board

E Alarcon

Universidad Politecnica de Madrid
Spain

C Alessandri

Universita di Ferrara
Italy

S A Anagnostopoulos

University of Patras
Greece

E Angelino

A.R.P.A. Lombardia
Italy

H Antes

Technische Universitat Braunschweig
Germany

D Aubry

Ecole Centrale de Paris
France

D E Beskos

University of Patras
Greece

J J Bommer

Imperial College London
UK

F Butera

Politecnico di Milano
Italy

P G Carydis

National Technical
University of Athens
Greece

J Chilton
University of Nottingham
UK

S Clement
Transport System Centre
Australia

M C Constantinou
State University of New York at Buffalo
USA

G Degrande
Katholieke Universiteit
Leuven
Belgium

A De Naeyer
Universiteit Ghent
Belgium

W P De Wilde
Vrije Universiteit Brussel
Belgium

J Dominguez
University of Seville
Spain

F P Escrig
University of Seville
Spain

M N Fardis
University of Patras
Greece

C J Gantes
National Technical
University of Athens
Greece

L Gaul
Universitat Stuttgart
Germany

Y Hayashi
Nagoya University
Japan

M Iguchi
Science University of Tokyo
Japan

L Int Panis
VITO Expertisecentrum IMS
Belgium

W Jager
Technical University of Dresden
Germany

C M Jefferson
University of the West of
England
UK

D L Karabalis
University of Patras
Greece

E Kausel
Massachusetts Institute of
Technology
USA

K Kawashima
Tokyo Institute of Technology
Japan

A N Kounadis
National Technical
University of Athens
Greece

W B Kratzig
Ruhr Universitat Bochum
Germany

A A Liolios
Democritus University of
Thrace
Greece

J W S Longhurst
University of the West of England,
UK

J E Luco
University of California at
San Diego
USA

L Lundqvist
Unit for Transport and Location Analysis
Sweden

M Majowiecki
University of Bologna
Italy

G D Manolis
Aristotle University of Thessaloniki
Greece

G Mattrisch
DaimlerChrysler AG
Germany

F M Mazzolani
University of Naples "Federico II"
Italy

K Miura
Kajima Corporation
Japan

G Oliveto
Universitá di Catania
Italy

E Oñate
Universitat Politecnica de
Catalunya
Spain

A S Papageorgiou
Rensselaer Polytechnic Institute
USA

G G Penelis
Aristotle University of
Thessaloniki
Greece

A M Reinhorn
State University of New York at Buffalo
USA

F Robuste
Universitat Politecnica de
Catalunya
Spain

C W Roeder
University of Washington
USA

J M Roesset
Texas A & M University
USA

M Saiidi
University of Nevada-Reno
USA

F J Sanchez-Sesma
Instituto Mexicano del
Petroleo
Mexico

S A Savidis
Technische Universitat Berlin
Germany

J J Sendra
University of Seville
Spain

Q Shen
Massachusetts Institute of Technology
USA

A C Singhal
Arizona State University
USA

P D Spanos
Rice University
USA

C C Spyarakos
National Technical
University of Athens
Greece

H Takemiya
Okayama University
Japan

I Takewaki
Kyoto University
Japan

E Taniguchi
Kyoto University
Japan

J L Tassoulas
University of Texas at Austin
USA

M A P Taylor
University of South Australia
Australia

R Tremblay
Ecole Polytechnique
Canada

R van der Heijden
Radboud University
Netherlands

R van Duin
Delft University of
Technology
Netherlands

A Yeh
The University of Hong Kong
China

M Zador
Technical University of
Budapest
Hungary

R Zarnic
University of Ljubljana
Slovenia

Eco-Architecture

Harmonisation between Architecture and Nature

Editors

G. Broadbent

University of Portsmouth, UK

C. A. Brebbia

Wessex Institute of Technology, UK

WITPRESS Southampton, Boston



G. Broadbent

University of Portsmouth, UK

C. A. Brebbia

Wessex Institute of Technology, UK

Published by

WIT Press

Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK

Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853

E-Mail: witpress@witpress.com

<http://www.witpress.com>

For USA, Canada and Mexico

Computational Mechanics Inc

25 Bridge Street, Billerica, MA 01821, USA

Tel: 978 667 5841; Fax: 978 667 7582

E-Mail: infousa@witpress.com

<http://www.witpress.com>

British Library Cataloguing-in-Publication Data

A Catalogue record for this book is available
from the British Library

ISBN: 1-84564-171-X

ISSN: 1746-4498 (print)

ISSN: 1743-3509 (online)

*The texts of the papers in this volume were set
individually by the authors or under their supervision.
Only minor corrections to the text may have been carried
out by the publisher.*

No responsibility is assumed by the Publisher, the Editors and Authors for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

© WIT Press 2006

Printed in Great Britain by Athenaeum Press Ltd., Gateshead.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Publisher.

Preface

This book contains the edited papers of the First International Conference on Harmonisation between Architecture and Nature (ECO-ARCHITECTURE 2006), which took place at the Wessex Institute of Technology Campus in the New Forest, UK.

Unlike the mechanistic buildings it replaces, Eco-Architecture is in harmony with nature, including its immediate environs. Decisions have to be taken on ecological grounds concerning locations, siting and orientation, as well as the well-informed choice of materials.

Eco-Architecture makes every effort to minimise the use of energy at each stage of the building's life cycle, including that embodied in the extraction and transportation of materials, their fabrication, their assembly into the building and ultimately the ease and value of their recycling when the building's life is over. The design may also take into consideration the use of energy in building maintenance and changes in its use, not to mention its lighting, heating and cooling, particularly where the energy consumed involves the emission of greenhouse gases.

Substantial savings can be achieved by passive energy systems, especially natural ventilation, summer shading and winter solar heat gain. Solar energy may be used in panel pipes for heating water and photovoltaic cells.

The development of Eco-Architecture is driven by the depletion of natural resources, especially fossil fuels and the need to preserve the balance of nature. The extensive use of steel and glass and the built-in problems of discomfort from solar over-heating and winter heat loss, has led to the widespread use of mechanical systems. Eco-Architecture is providing instead imaginative and expressive solutions driven by a generation of highly creative designs. It has important cultural as well as architectural impacts.

Eco-Architecture is by definition inter-disciplinary; it requires the collaboration of engineers, planners, physicists, sociologists, economists, and other specialists, in addition to architects. The papers contained in this book were written by different specialists and attempt to focus on the interdisciplinary character of eco-architecture.

The editors are grateful to all the authors for the quality of their papers and to the members of the International Scientific Advisory Committee as well as other colleagues who helped to review the papers.

The Editors,
The New Forest
2006

Contents

Section 1: Ecological and cultural sensitivity

Cultural responses to primitive needs <i>N. Baker</i>	3
Ecological propriety and architecture <i>V. A. Metallinou</i>	15
Architecture and nature at the end of the 20th century: towards a dialogical approach for sustainable design in architecture <i>F. J. Soria López</i>	23
The keyword is quality not ecology <i>A. van Hal</i>	35
In-between architecture and landscape, from theory to practice <i>B. Ott</i>	45
Ecological, modular and affordable housing <i>J. Quale</i>	53
Flexi-Living: adaptable property, adaptable housing, transforming lives <i>I. MacBurnie</i>	63
The study of restoring an eco-habitat of the traditional Paiwan tribe in Taiwan <i>C.-J. Chen</i>	73
Urban planning and the quality of life in Putrajaya, Malaysia <i>D. Bt Omar</i>	83

Section 2: Historical and philosophical aspects

Evaluating the sophistication of vernacular architecture to adjust to the climate <i>E. Tsianaka</i>	93
Examining line as a heuristic device in the design ethos of Alvar Aalto <i>P. Harwood</i>	103
Historical influences of wind and water in selecting settlement sites <i>P. Kilby</i>	115
Unity, simplicity and balance: sustainable management of cultural historic environments of mountain summer farming <i>G. Swensen</i>	123
A tale of two city halls: icons for sustainability in London and Seattle <i>D. Armpriest & B. Haglund</i>	133
Poetic water images in architecture <i>U. Kirschner</i>	143

Section 3: Design with nature

The 2005 Solar D house <i>M. Garrison</i>	155
Fractal geometry and architecture: some interesting connections <i>N. Sala</i>	163
Symbols, metaphors, analogues: seeding, modelling and achieving sustainable design <i>R. J. Koester</i>	175
A methodology for sustainable design analysis of large scale buildings <i>R. Richarde & R. Ibrahim</i>	185
Developing designs in balance with nature <i>A. J. Anselm</i>	195
Outdoor residential landscape design in an arid natural conservation area: Bahía de Los Angeles, México <i>R. Rojas-Caldelas, G. Bojórquez-Morales, A. Luna-León, E. Corona-Zambrano & J. Ochoa-Corrales</i>	205

The house by the lake <i>C. A. Brebbia & J. Gorst</i>	215
Indicators for the ecological planning of buildings <i>C. Seyler, C. Stoy, I. Lützelchwab & S. Kytzia</i>	227
Sustainable building design in Australia <i>C. McCabe</i>	237
Design and construction: changing the role <i>P. Rossi</i>	247

Section 4: Assessment and selection of materials

Natural materiality – the people’s choice <i>F. Stevenson</i>	257
Environmental impact of materials used in technical equipments: an overview on different methods <i>L. Marletta, G. Evola & F. Sicurella</i>	267
Designing for longevity <i>V. Straka</i>	277
Natural building systems: experiments in urban ecology <i>K. Connors</i>	287
Promoting sustainability of earth constructed private and public buildings in South Africa <i>G. Bosman</i>	297

Section 5: Natural technologies

Heteronomy and (un)sustainability of essential technical infrastructures <i>A. van Timmeren</i>	309
Eco-design of technological systems in buildings <i>L. Marletta, G. Evola & F. Sicurella</i>	319

Section 6: Design by passive systems

Sound barriers to enable open windows and integration in landscape <i>G. Rosenhouse</i>	331
--	-----

Practicing what we preach
M. Lawton341

Guidelines for sizing roof windows
S. Robertson & M. Thompson351

Section 7: Building operation and maintenance

Building defects: survey and impact over sustainability
E. Costanzo361

Cob seismic rehabilitation
G. Scudo & A. Drei369

Section 8: Water conservation

Rainwater harvesting in Brazil: investigating the viability of
rainwater harvesting for a household in Brasília
D. Sant'Ana381

Reliability of rainwater harvesting
J. W. Male & M. S. Kennedy391

User experiences with decentralised water systems in an
ecological residential area
A. A. E. Luisng401

Author index409