Ecosystems and Sustainable Development VII

WIT PRESS

WIT Press publishes leading books in Science and Technology.
Visit our website for new and current list of titles.
www.witpress.com

WIT eLibrary

Home of the Transactions of the Wessex Institute.
Papers presented at Ecosystems and Sustainable Development VII are archived in the WIT eLibrary in volume 122 of WIT Transactions on Ecology and the Environment (ISSN 1743-3541).
The WIT eLibrary provides the international scientific community with immediate and permanent access to individual papers presented at WIT conferences.
Visit the WIT eLibrary at www.witpress.com.

SEVENTH INTERNATIONAL CONFERENCE ON
ECOSYSTEMS AND SUSTAINABLE DEVELOPMENT

ECOSUD VII

CONFERENCE CHAIRMEN

C.A. Brebbia
Wessex Institute of Technology, UK

E. Tiezzi
University of Siena, Italy

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

P. Amrusch	M. Fullen	B.C. Patten
C.A. Booth	A. Gnauck	A. Tadeu
T-S. Chon	R.J. Lilieholm	W. Timmermans
M. Cortes Molina	U. Mander	R.E. Ulanowicz
M. da Conceicao Cunha	J.C. Marques	Y. Villacampa

Organised by
Wessex Institute of Technology, UK
University of Siena, Italy

In collaboration with
The International Journal of Design & Nature and Ecodynamics

Sponsored by
WIT Transactions on Ecology and the Environment

WIT Transactions

Transactions Editor

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

Editorial Board

Ecosystems and Sustainable Development VII

Editors:

C.A. Brebbia
Wessex Institute of Technology, UK

E. Tiezzi
University of Siena, Italy

WIT PRESS Southampton, Boston

Editors:

C.A. Brebbia
Wessex Institute of Technology, UK

E. Tiezzi
University of Siena, Italy

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: 978-1-84564-194-8
ISSN: 1746-448X (print)
ISSN: 1743-3541 (on-line)

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.

Printed in Great Britain by Athenaeum Press Ltd.

Preface

The root of the acronym ECOSUD, the title of the conference on ecosystems and sustainable development, is the Greek word *oikos*, meaning house. House, our common house, is nothing else but our planet – the only one we have – with all its resources, services, goods and functions that make life possible. The same Greek word is also the root of two academic disciplines dealing with that house: on the one hand we have ecology, as the sum of *oikos* and *logos*, meaning the study of the house; on the other hand we have economics, as the sum of *oikos* and *nomos*, meaning the management of the house. Up to now, a relationship between economics and ecology is still under construction. Eugene Odum, one of the promoters of modern ecology, in 1977 wrote: [Ecology and economics will] "…remain poles apart on college campuses as well as in the minds of the general public as long as each restricts itself to only a part of the house, nature's and man's part, respectively". However, certain points are clear: a) ecology teaches economists that there are economic costs distant in space (the whole planet) and time (future generations); b) ecology reveals that many environmental and human costs cannot be reduced to economic units; c) if production only obeys economic laws, what is produced will not necessarily be to man's benefit. In fact, environmental deterioration and dissipation of resources continue to penalize social development. The gap between rich and poor countries and the scarcity of resources point in the direction of unacceptable inequities and increased probability of war. In particular, the quality of our existence depends on the quality of our land (nature, towns and country) and the quality of the human activities that it hosts. Any attack upon this quality to the advantage of a few and the detriment of the rest is unacceptable, even if motivated by allegedly inexorable economic necessity (the 'iron laws' of the market, competition and the like). In the long run, the destruction of natural resources and the environment does not pay in economic or social terms. In a few words, it is not sustainable.

Nowadays, we strongly need an improvement in communication among disciplines, going from specialisation and juxtaposition to cooperation, coordination and finally what today is called transdisciplinarity or *cross-fertilisation*. Besides giving rise to major scientific innovations, transdisciplinary approaches have practical

implications, especially for the study of environmental dynamics in relation to human activity.

This is the reason why the International Conference on Ecosystems and Sustainable Development – ECOSUD 2009 is so important. ECOSUD offers a unique opportunity and encourages the transdisciplinary communication between scientists, engineers and professionals working in ecological systems and sustainable development. The Conference objectives have evolved over the years, seeking to integrate thermodynamics, ecology and economics into "ecodynamics".

This Volume contains the proceedings of the Seventh International on Conference Ecosystems and Sustainable Development that was held in Chianciano Terme (Siena, Italy) in 2009. The papers have been arranged in the following sections:

- Greenhouse issues
- Ecosystems modelling
- Mathematical and system modelling
- Natural resources management
- Environmental indicators
- Sustainability development studies
- Recovery of damaged areas
- Energy and the environment
- Socio economic factors
- Soil contamination
- Waste management
- Water resources
- Environmental management

The Editors would like to thank the members of the International Scientific Advisory Committee for their help in reviewing the papers and promoting the Conference, and the authors for their contributions.

The Editors
Siena, 2009

Contents

Section 5: Environmental indicators

Section 6: Sustainability development studies