Sustainable Irrigation Management, Technologies and Policies
FIRST INTERNATIONAL CONFERENCE ON SUSTAINABLE IRRIGATION MANAGEMENT, TECHNOLOGIES AND POLICIES

Sustainable Irrigation 2006

CONFERENCE CHAIRMEN

G. Lorenzini
Alma Mater Studiorum-University of Bologna, Italy

C. A. Brebbia
Wessex Institute of Technology, UK

ISAC CHAIRMAN

D. De Wrachien
University of Milan, Italy

INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE

A. Canu
A. Cheng
M. Gomez
A. Guarnieri
W. M. Hanemann
R. Mohtar
G. Oron
M. Portapila
J. Rodellar
A. Segré
I. Smout
J. M. Tarjuelo
L. Vannini

Organised by
Wessex Institute of Technology, UK

Sponsored by
WIT Transactions on Ecology and the Environment
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>R O’Neill</td>
<td>Oak Ridge National Laboratory</td>
<td>USA</td>
</tr>
<tr>
<td>J Park</td>
<td>Seoul National University</td>
<td>Korea</td>
</tr>
<tr>
<td>B C Patten</td>
<td>University of Georgia</td>
<td>USA</td>
</tr>
<tr>
<td>V Popov</td>
<td>Wessex Institute of Technology</td>
<td>UK</td>
</tr>
<tr>
<td>M R I Purvis</td>
<td>University of Portsmouth</td>
<td>UK</td>
</tr>
<tr>
<td>A D Rey</td>
<td>McGill University</td>
<td>Canada</td>
</tr>
<tr>
<td>R Rosset</td>
<td>Laboratoire d’Aerologie</td>
<td>France</td>
</tr>
<tr>
<td>S G Saad</td>
<td>American University in Cairo</td>
<td>Egypt</td>
</tr>
<tr>
<td>J J Sharp</td>
<td>Memorial University of Newfoundland</td>
<td>Canada</td>
</tr>
<tr>
<td>I V Stangeeva</td>
<td>St Petersburg University</td>
<td>Russia</td>
</tr>
<tr>
<td>T Tirabassi</td>
<td>Institute FISBAT-CNR</td>
<td>Italy</td>
</tr>
<tr>
<td>J-L Uso</td>
<td>Universitat Jaume I</td>
<td>Spain</td>
</tr>
<tr>
<td>A Viguri</td>
<td>Universitat Jaume I</td>
<td>Spain</td>
</tr>
<tr>
<td>G Walters</td>
<td>University of Exeter</td>
<td>UK</td>
</tr>
<tr>
<td>K Onishi</td>
<td>Ibaraki University</td>
<td>Japan</td>
</tr>
<tr>
<td>G Passerini</td>
<td>Universita delle Marche</td>
<td>Italy</td>
</tr>
<tr>
<td>M F Platzer</td>
<td>Naval Postgraduate School</td>
<td>USA</td>
</tr>
<tr>
<td>H Power</td>
<td>University of Nottingham</td>
<td>UK</td>
</tr>
<tr>
<td>Y A Pykh</td>
<td>Russian Academy of Sciences</td>
<td>Russia</td>
</tr>
<tr>
<td>A C Rodrigues</td>
<td>Universidade Nova de Lisboa</td>
<td>Portugal</td>
</tr>
<tr>
<td>J L Rubio</td>
<td>Centro de Investigaciones sobre Desertificacion</td>
<td>Spain</td>
</tr>
<tr>
<td>R San Jose</td>
<td>Technical University of Madrid</td>
<td>Spain</td>
</tr>
<tr>
<td>H Sozer</td>
<td>Illinois Institute of Technology</td>
<td>USA</td>
</tr>
<tr>
<td>E Tiezzi</td>
<td>University of Siena</td>
<td>Italy</td>
</tr>
<tr>
<td>S G Tushinski</td>
<td>Moscow State University</td>
<td>Russia</td>
</tr>
<tr>
<td>R van Duin</td>
<td>Delft University of Technology</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Y Villacampa Esteve</td>
<td>Universidad de Alicante</td>
<td>Spain</td>
</tr>
</tbody>
</table>
Sustainable Irrigation Management, Technologies and Policies

Editors:

G. Lorenzini
Alma Mater Studiorum-University of Bologna, Italy

C. A. Brebbia
Wessex Institute of Technology, UK
G. Lorenzini  
Alma Mater Studiorum-University of Bologna, Italy

C. A. Brebbia  
Wessex Institute of Technology, UK

Published by

WIT Press  
Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK  
Tel: 44 (0) 23 8029 3223; Fax: 44 (0) 23 8029 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: 1-84564-043-8
ISSN: 1746-448X (print)  
ISSN: 1743-3541 (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 Cambridge Printing

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 most of the papers presented at the First International Conference on Sustainable Irrigation, Management, Technologies and Policies, held in Bologna in 2006 and organised by the Wessex Institute of Technology. The objective of the Meeting was to bring together engineers, scientists and managers from laboratories, industry, government and academia to exchange knowledge in the field of irrigation in its broadest sense. The conference aimed to cover technical as well as policy related topics in order to find innovative solutions for the many problems to be resolved in order to reach sustainable irrigation solutions.

The emphasis of the Conference on inter-disciplinary activities explored new areas for collaboration among different professionals involved in irrigation studies and applications. This made the First International Conference unique.

Irrigation is of great relevance in many fields, such as agriculture, landscaping, water management, water policies and economics, amongst others. Improving our understanding of technical as well as economic issues can lead not only to a better understanding of the topic and all aspects of the problem, but also to find more effective solutions.

This book contains the following sections: Irrigation controls; Irrigation systems and planning; Irrigation modelling; Irrigation management.

The organisers are grateful to the members of the International Scientific Advisory Committee who have helped with the selection of the papers included in the book, as well as to all contributors. The quality of the material makes this Volume a most valuable tool for scientists and researchers to appreciate the state-of-the-art in this important field.

The Editors
Bologna, 2006
# Contents

## Section 1: Irrigation controls

Surface irrigation with a variable inflow hydrograph  
*B. Mostafazadeh-Fard & Y. Osroosh*  ................................................................. 3

Simulation of performance for a simple real time control system of furrow irrigation  
*K. L. Khatri & R. J. Smith*  ................................................................................. 13

## Section 2: Irrigation systems and planning

Sustainable irrigation in South China: a case study of the Chengyang valley  
*A. de Miranda*  ..................................................................................................... 25

Evapotranspiration, yield, crop coefficients, and water use efficiency of drip and furrow irrigated processing tomatoes  
*B. Hanson & D. May*  .......................................................................................... 31

Problems of the irrigation system in the Turpan Basin of China  
*T. Nagasawa, T. Yamamoto & A. Jalaldin*  ......................................................... 37

Allocation of flow to plots in pressurized irrigation distribution networks  
*J. Monserrat*  ......................................................................................................... 45

Assessing canal seepage and soil salinity using the electromagnetic remote sensing technology  
*F. Cassel S. & D. Zoldoske*  .................................................................................. 55

Is drip irrigation sustainable in the salt affected soil of the San Joaquin Valley of California?  
*D. May & B. Hanson*  .......................................................................................... 65
Managing salinity in degraded soils by mandatory tree planting: on dynamics and economic modeling of a common pool resource
E. A. Nuppenau ...................................................................................................71

Local-scale solute transport in variously structured soils under continuous flood irrigation
A. Comegna, A. Coppola, A. Sommella & G. Severino........................................85

Section 3: Irrigation modelling

AWAM: a model for optimal land and water resources allocation
I. Smout & S. D. Gorantiwar ................................................................................103

Sustainable irrigation in the Yanqi basin, China
P. Brunner, W. Kinzelbach, W. P. Li & X. G. Dong ........................................115

Water productivity: a basic tool for sustainable irrigation
M. N. Nimah, S. N. Moukarzel, M. R. Darwish, N. Farajalla
& I. Bashour....................................................................................................127

Kerman weighing electronic lysimeter error analysis
B. Bakhtiari, R. Kamyab Moghadas, M. J. Khanjani & H. Taraz ....................137

Improving irrigation practice in New Zealand
R. J. Martin, S. M. Thomas, D. J. Bloomer, R. F. Zyskowski,
P. D. Jamieson, W. J. Clarke-Hill & C. G. L. Pennell.....................................149

Hydraulic modelling of drip irrigation systems used for grass establishment on steep slopes
Y. Gyasi-Agyei................................................................................................159

Development of a crop water use module for the WAS program to determine scheme-level irrigation demand
I. van der Stoep & N. Benade........................................................................171

Subsurface irrigation by condensation of humid air
J. Lindblom & B. Nordell..............................................................................181

Theoretical and experimental analysis on the thermal fluid dynamics of water droplets in irrigation
G. Lorenzini & D. De Wrachien .................................................................191
Section 4: Irrigation management

Social and irrigation water management issues in some water user’s associations of the Low Segura River Valley (Alicante, Spain)

Towards sustainable irrigation in Western Australia

“Custodians” or “Investors”: classifying irrigators in Australia’s Namoi Valley
G. Kuehne & H. Bjornlund ............................................................................225

Irrigation management: the optimization perspective
M. da Conceição Cunha....................................................................................237

Decision support systems for efficient irrigated agriculture
R. Oad, L. Garcia, K.-D. Kinzli & D. Patterson............................................247

Irrigation with low quality water: model approach
A. Refsgaard & M. Styczen ............................................................................257

Quarry plans in the management of water resources: case study of the River Serio
G. Ravazzani, M. Mancini & S. Meucci........................................................267

Strategic decision-making for water resource management in semi-arid metropolitan and rural areas
W. J. de Lange & T. E. Kleynhans ..............................................................277

Increased participation in Australian water markets
H. Bjornlund......................................................................................................289

Irrigated agriculture and the environment in the Tarim River watershed: case study of the Shaya irrigation district in the Ugen River basin
T. Yamamoto, T. Nagasawa & A. Jalaldin.....................................................303

Energy revenue in irrigation systems: a case study
G. de Marinis, A. Russo & A. Del Greco........................................................313

Rio Grande Basin water conservation project
G. Piccinni, D. Supercinski, D. Leskovar, B. Harris & C. A. Jones..................321
Promoting the effective use of water in the irrigation of permanent crops in the Western Cape Province of South Africa
A. S. Roux ...........................................................................................................331

Surface measurements of hydraulic properties in an irrigated soil using a disc permeameter
A. Comegna, G. Severino & A. Sommella..........................................................341

The contribution of water accounting to irrigation efficiency
P. Taylor & E. Harris .......................................................................................355

Crop management in a district within the Ebro River Basin using remote sensing techniques to estimate and map irrigation volumes

Cost-effectiveness analysis of measures to reduce nitrogen loads from agriculture: do secondary benefits matter?
J. S. Schou & K. Birr-Pedersen.........................................................................379

Author index ....................................................................................................389