



DEVELOPMENTS IN
ECOSYSTEMS

1

WETLANDS ECOSYSTEMS IN ASIA: FUNCTION AND MANAGEMENT

EDITED BY
M.H. WONG



DEVELOPMENTS IN ECOSYSTEMS 1

WETLANDS ECOSYSTEMS IN ASIA: FUNCTION AND MANAGEMENT

EDITED BY

M.H. WONG

CROUCHER INSTITUTE FOR ENVIRONMENTAL SCIENCES

HONG KONG BAPTIST UNIVERSITY

KOWLOON TONG, HONG KONG

2004



ELSEVIER

Amsterdam – Boston – Heidelberg – London – New York – Oxford
Paris – San Diego – San Francisco – Singapore – Sydney – Tokyo

ELSEVIER B.V.
Sara Burgerhartstraat 25
P.O. Box 211, 1000 AE
Amsterdam, The Netherlands

ELSEVIER Inc.
525 B Street, Suite 1900
San Diego, CA 92101-4495
USA

ELSEVIER Ltd
The Boulevard, Langford Lane
Kidlington, Oxford OX5 1GB
UK

ELSEVIER Ltd
84 Theobalds Road
London WC1X 8RR
UK

© 2004 Elsevier B.V. All rights reserved.

This work is protected under copyright by Elsevier B.V., and the following terms and conditions apply to its use:

Photocopying

Single photocopies of single chapters may be made for personal use as allowed by national copyright laws. Permission of the Publisher and payment of a fee is required for all other photocopying, including multiple or systematic copying, copying for advertising or promotional purposes, resale, and all forms of document delivery. Special rates are available for educational institutions that wish to make photocopies for non-profit educational classroom use.

Permissions may be sought directly from Elsevier's Rights Department in Oxford, UK: phone (+44) 1865 843830, fax (+44) 1865 853333, e-mail: permissions@elsevier.com. Requests may also be completed on-line via the Elsevier home-page (<http://www.elsevier.com/locate/permissions>).

In the USA, users may clear permissions and make payments through the Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, USA; phone: (+1) (978) 7508400, fax: (+1) (978) 7504744, and in the UK through the Copyright Licensing Agency Rapid Clearance Service (CLARCS), 90 Tottenham Court Road, London W1P 0LP, UK; phone: (+44) 20 7631 5555; fax: (+44) 20 7631 5500. Other countries may have a local reprographic rights agency for payments.

Derivative Works

Tables of contents may be reproduced for internal circulation, but permission of the Publisher is required for external resale or distribution of such material. Permission of the Publisher is required for all other derivative works, including compilations and translations.

Electronic Storage or Usage

Permission of the Publisher is required to store or use electronically any material contained in this work, including any chapter or part of a chapter.

Except as outlined above, no part of this work may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the Publisher.

Address permissions requests to: Elsevier's Rights Department, at the fax and e-mail addresses noted above.

Notice

No responsibility is assumed by the Publisher 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. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made.

First edition 2004

Library of Congress Cataloging in Publication Data

A catalog record is available from the Library of Congress.

British Library Cataloguing in Publication Data

A catalogue record is available from the British Library.

ISBN: 0-444-51691-3

ISSN: 1572-7785 (Series)

The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

© Printed in The Netherlands.

Working together to grow
libraries in developing countries

www.elsevier.com | www.bookaid.org | www.sabre.org

ELSEVIER

BOOK AID
International

Sabre Foundation



DEVELOPMENTS IN ECOSYSTEMS 1

**WETLANDS
ECOSYSTEMS IN ASIA:
FUNCTION AND MANAGEMENT**

Preface

Compared to other ecosystems, wetlands have received an exceptional amount of attention. Wetlands are valuable as sources, sink and transformers of a multitude of chemical, biological and genetic materials. They stabilize water supplies, clean polluted waters, protect shorelines, and recharge groundwater aquifers. They have increasingly become recognized for their unique ecological functions in the environment and are the focus of increased research by scientists and study programs by schools, communities, and nature centers. On the other hand, the idea of using constructed wetlands for wastewater treatment has been encouraging because of their environmental friendliness and enhancement on landscape quality. Consequently, interest in wetlands extends from students in landscape architecture and environmental engineering programs to the real world of public officials, developers, and private citizens.

Wetland management requires an understanding of the scientific aspects of wetland balanced with legal institutional and economic realities. This book consists of comprehensive information of wetland's importance, functions, conservation and management strategies, which will be beneficial to environmental professionals in different fields for formulating wetland conservation policy and conducting environmental research. The latest and advanced information and management techniques of using constructed wetland for wastewater treatment are also included in this book.

This book is the product of the Croucher Advanced Study Institute on Wetland Ecosystems in Asia: Function and Management held in March 2003 at Hong Kong Baptist University, attended by a selected number of specialists and practitioners, to review the major problems involved in wetland management, and how they can be solved, against a background of situations in Asian countries. The Asian region contains some of the world's largest and diverse seagrass beds and about half of the approximately 50 seagrass species known world-wide occur along Asian coasts. These seagrass beds, mainly via the detritus food chain, support a very productive community of fish and invertebrates, especially mollusks and crustaceans, many of which are of commercial importance. The South-East Asian peat swamp forests cover nearly 30 million hectares compared to only one

million hectares in Amazonia. Asia's major rivers (a wetland habitat) are some of the world's largest and most of the rivers of Asia have extensive floodplain wetlands. The region also contains the world's largest contiguous area of mangroves – the Sundarbans in Bangladesh, and the country with the world's largest expanse of mangroves – Indonesia. It is also global center for mangrove diversity and evolution. In terms of freshwater ecosystems, the swamp forests of South-East Asia are not only among the largest and the best developed in the world, but are botanically among the most diverse, while exhibiting a high degree of endemism.

Unfortunately, wetlands throughout Asia are under threat, destruction and degradation continues unabated. Analysis showed that of nearly 1,000 wetlands considered to be of international importance for socio-economic or biodiversity values in Asia, as many as 56% were considered to be moderately or seriously threatened, while only 15% were threatened. In addition, only about 10% of these internationally important wetlands are currently totally protected, while a further 15% is partially protected.

To date, in South-East Asia, 5 countries have developed their own National Wetland Policy or Wetland Action Plan or National Wetland Strategy. They are Indonesia, Philippines, Vietnam, Thailand and Cambodia. This book discussing different wetland management strategies in Asia will act as a reference book for environmental professionals in other Asian countries to formulate conservation policy for their own countries.

The book consists of 4 sessions: I. Natural Wetland Systems and Their Functions; II. Wetland Biogeochemistry; III. Wetland Management Strategies in Asia and IV. Constructed Wetlands. The basic information of natural wetland systems is introduced in Session I. More scientific discussion about the biogeochemistry of wetland can be found in Session II. In Session III, wetland management strategies of different Asian countries, including Malaysia, the Philippines, Vietnam, Thailand and Hong Kong are discussed. Although only Asian experience has been shared, past experience shows that there is a body of general rules applicable to different wetland systems of different countries. The latest and advanced information and management techniques of constructed wetlands can be found in Session IV which will be useful for environmental managers and engineers working on constructed wetland projects.

We hope that this book will not only be beneficial to environmental professionals for formulating wetland conservation policy and conducting environmental research, but it will also serve as a reference book for students of undergraduate and graduate courses on ecology and conservation.

About the Editor

Professor Ming H. Wong

After graduation from the Chinese University of Hong Kong with a BSc in Biology, Professor Wong obtained his MSc, PhD and DSc from the University of Durham and also MBA and DSc from the University of Strathclyde. Professor Wong served the Biology Department of The Chinese University of Hong Kong as Lecturer and Senior Lecturer from 1973–85, following which he became Head of the Biology Department of Hong Kong Baptist University (1986–2002) and was promoted to Chair Professor in 1990. He currently serves as Director of the Croucher Institute for Environmental Sciences, Hong Kong.

Professor Wong's research work centers around restoration of derelict land and pollution ecology, especially heavy metals in earlier years, and persistent toxic substances more recently. He serves as regional co-ordinator of Central and North East Asia for the project "Regionally based assessment of persistent toxic substances" sponsored by the Global Environmental Facility (GEF) and implemented by the United Nations Environment Programme (UNEP).

Professor Wong has over 200 papers published in international scientific journals and edited several books. He serves on editorial boards of eight scientific journals related to environmental science, including Editor-in-Chief of the journal "Environmental Geochemistry and Health (Kluwer Academic Press)" and is a Visiting Professor of several major institutes in Mainland China such as Nanjing Institute of Soil Science of The Chinese Academy of Science, Zhejiang University, Wuhan University, and Zhongshan University, and also Middlesex University in the UK.

Acknowledgements

“Croucher Advanced Study Institutes” (ASI) are a new funding initiative of the Croucher Foundation catering to the interests of established scientists. The main objective of the ASI program is to regularly bring to Hong Kong leading international experts in specific fields, to conduct refresher programs for a limited number of established scientists in highly focused scientific topics.

The financial support from the Croucher Foundation is gratefully acknowledged. We would also like to express our sincere gratitude to World Wide Fund for Nature (Hong Kong), Middlesex University (UK), Nanjing Institute of Soil Science and Zhongshan University (PR China) for co-organizing the event and all the authors for their contributions.

I would also like to thank Dr John Waughman (Durham City, UK) for his invaluable comments on all the papers and Ms Doris Ng (Hong Kong Baptist University) for her expert editorial assistance.

Ming H. Wong, PhD, DSc (Durham), MBA, DSc (Strathclyde)
Director/Chair Professor
Croucher Institute for Environmental Sciences

Abridged Contents

Session I. Natural Wetland Systems and Their Functions

1. A Comparison of Issues and Management Approaches in Moreton Bay, Australia and Chesapeake Bay, USA
W.C. Dennison, T.J.B. Carruthers, J.E. Thomas, P.M. Glibert 3
2. Wetland Utilization and Protection in China
Q.G. Zhao, J. Song 27
3. Ecological and Environmental Function of Wetland Landscape in the Liaohe Delta
D.N. Xiao, X.Z. Li 35
4. The Dyke-Pond Systems in South China: Past, Present and Future
M.H. Wong, K.C. Cheung, A. Yediler, C.K.C. Wong 47

Session II. Wetland Biogeochemistry

5. Heavy Metal Mobility and Aquatic Biogeochemical Processes at Mai Po Marshes Nature Reserve, Hong Kong
Y. Liang, M.H. Wong 69
6. Biogeochemistry of Metals in the Rhizosphere of Wetland Plants — An Explanation for “Innate” Metal Tolerance?
M.L. Otte, D.J. Matthews, D.L. Jacob, B.M. Moran, A.J.M. Baker 87
7. Mycotrophy and Its Significance in Wetland Ecology and Wetland Management
A.G. Khan 95
8. Assessment of Risks to the Mai Po/Inner Deep Bay Ramsar Site due to Environmental Contaminants
P.K.S. Lam, M.H.W. Lam 115

9. Modelling Contamination in an Urban Canal Sediment:
Some Preliminary Results from a Phytoremediation Project
*N.M. Dickinson, R. King, A. Royle, I.D. Pulford, W. Hartley,
J. Jones, E. Gray-Jones, P.D. Putwain* 131

Session III. Wetland Management Strategies in Asia

10. Conflicts in the Management of a Wetland Nature
Reserve — Case Study of the Mai Po Nature Reserve, Hong Kong
L. Young 145
11. Conservation and Uses of Mangroves in Hong Kong and
Mainland China
N.F.Y. Tam 161
12. An Integrated Analysis of Sustainable Human–Water Interactions
in Wetland Ecosystems of Taihu Lake Basin, East China
D. Hu, J.S. Yan, T.X. Liu, G.W. Chen, S.J. Yuan, R.S. Wang 183
13. Ecological Benefits of Italian Poplar Afforestation in Wetland Areas
along the Yangtze River, Fanchang County of Anhui Province
Z.J. Xi, D. Hu, R.X. Wang 221
14. Wetland Conservation and Management in the Philippines:
Where Are We Now? The Case of Seagrass and Mangrove
M.D. Fortes 233
15. Economic Valuation of Mangroves for Improved Usage and
Management in Thailand
C. Tingsabadh, S. Pongkijvorasin 263

Session IV. Constructed Wetlands

16. Constructed Wetlands for Wastewater Treatment: Principles
and Practices
C. Polprasert 285
17. Planting, Selection and Plant Establishment in Constructed
Wetlands in a Tropical Environment
M. Beharrell 311
18. Nitrogen Removal Processes in Constructed Wetlands
C.C. Tanner 331

19.	Operation and Maintenance for Constructed Wetlands <i>M. Beharrell</i>	347
20.	Urban and Highway Runoff Treatment by Constructed Wetlands <i>R.B.E. Shutes, J.B. Ellis, D.M. Revitt, M. Forshaw, B. Winter</i>	361
21.	Wetland Ecosystems for Treatment of Stormwater in an Urban Environment <i>J. Gan</i>	383
22.	The Application of Constructed Wetlands for Water Quality Improvement in the Deep Bay Catchment of Hong Kong <i>M.W. Cha</i>	401
23.	Use of a Wetland System for Treating Pb/Zn Mine Effluent: A Case Study in Southern China from 1984 to 2002 <i>Z.H. Ye, M.H. Wong, C.Y. Lan</i>	413
24.	Wetland Creation in Hong Kong <i>S.S.S. Lau</i>	435

Contents

Abridged Contents	v
Preface	xxiii
About the Editor	xxv
Acknowledgements	xxvii

Session I. Natural Wetland Systems and Their Functions

Chapter 1. A Comparison of Issues and Management Approaches in Moreton Bay, Australia and Chesapeake Bay, USA <i>W.C. Dennison, T.J.B. Carruthers, J.E. Thomas, P.M. Glibert</i>	3
1.1. Introduction	3
1.2. Comparison of Systems	4
1.3. Moreton Bay Overview	6
1.4. Moreton Bay Sediments and Seagrass Loss	9
1.5. Moreton Bay Sewage Plumes	10
1.6. Moreton Bay Harmful Algal Blooms	11
1.7. Chesapeake Bay Overview	13
1.8. Chesapeake Bay Nutrient Over-Enrichment	14
1.9. Chesapeake Bay Critical Habitat Loss	15
1.10. Chesapeake Bay Sedimentation	17
1.11. Chesapeake Bay Harmful Algal Blooms	18
1.12. Overcoming Challenges	19
1.13. Healthy Waterways Campaign Overcomes Population Growth	19
1.14. Chesapeake Bay Blues	20
1.15. Mersey Basin Campaign Overcomes Cost Considerations	21
1.16. Mekong River Commission Overcomes Jurisdictional Issues	21
1.17. Conclusions	22
Acknowledgements	22
References	23

Chapter 2. Wetland Utilization and Protection in China	
<i>Q.G. Zhao, J. Song</i>	27
2.1. Brief Introduction to Wetland Resources in China	27
2.2. Problems Arising from Wetland Exploitation and Utilization	28
2.2.1. Over-Exploitation and Shrinking Wetlands	28
2.2.2. Wetlands' Quality Deterioration	29
2.2.3. Ecological Degradation and Reduced Biodiversity	32
2.3. Measures for Protection of China's Wetlands	32
2.4. Utilization and Protection of Coastal Wetland in Jiangsu Province	33
2.4.1. Problems Associated with Utilization of Mudflat	33
References	34
Chapter 3. Ecological and Environmental Function of Wetland Landscape in the Liaohe Delta	
<i>D.N. Xiao, X.Z. Li</i>	35
3.1. Introduction	35
3.2. Hydrological Adjustment of Wetland	36
3.2.1. Wetland Water Storage Capacity and Reed Field Evapotranspiration	36
3.2.2. Water Replacement Rate	37
3.3. Biomass Production and Output	39
3.4. Purification in the Wetland	39
3.4.1. Waste Water Irrigation in the Reed Field	39
3.4.2. Purification of the Reed Field to Waste Water from Paper Factory	41
3.5. Methane (CH ₄) Emission from the Natural Wetland	43
3.5.1. Seasonal Dynamics of CH ₄ Emission	43
3.5.2. The Effect of Reed Plants on CH ₄ Emission	44
3.6. Biodiversity Protection	45
3.7. Conclusion	46
Acknowledgements	46
References	46
Chapter 4. The Dyke-Pond Systems in South China: Past, Present and Future	
<i>M.H. Wong, K.C. Cheung, A. Yediler, C.K.C. Wong</i>	47
4.1. Introduction	48
4.2. The Dyke-Pond System in South China	49
4.2.1. Integrated Agricultural and Aquacultural Systems	50
4.2.2. General Principles of Using Manure in Polyculture of Fish	51
4.2.3. Nutrient Dynamics of Fish Ponds Using Manure as the Major Input	52
4.3. Recent Socio-Economic Changes and Their Effects on the Aquacultural Industries	53
4.3.1. South China and Persistent Organic Pollutants (POPs)	53

4.3.2. Environmental Impacts of Inland Aquaculture	55
4.4. Good Aquacultural Practices and Organic Fish Farming	59
4.5. Conclusion	61
Acknowledgements	62
References	62

Session II. Wetland Biogeochemistry

Chapter 5. Heavy Metal Mobility and Aquatic Biogeochemical Processes at Mai Po Marshes Nature Reserve, Hong Kong	
<i>Y. Liang, M.H. Wong</i>	69
5.1. Introduction	69
5.2. Materials and Methods	72
5.3. Results and Discussion	73
5.3.1. Comparisons of Physicochemical Properties of the Water and Sediments Between the Landward and Seaward Sides in <i>Gei Wais</i> at Mai Po Marshes	73
5.3.2. Comparisons of Aquatic Biological Processes Between the Landward and Seaward Sides in <i>Gei Wais</i> at Mai Po Marshes	73
5.3.3. Relationships Between Heavy Metal Concentrations in the Sediments and Aquatic Physicochemical Properties in <i>Gei Wais</i> at Mai Po Marshes	76
5.4. Conclusions	83
Acknowledgements	84
References	84
Chapter 6. Biogeochemistry of Metals in the Rhizosphere of Wetland Plants — An Explanation for “Innate” Metal Tolerance?	
<i>M.L. Otte, D.J. Matthews, D.L. Jacob, B.M. Moran, A.J.M. Baker</i>	87
6.1. General Biogeochemistry of Wetland Soils	87
6.2. The Rhizosphere of Wetland Plants	88
6.3. Metal Mobility in the Rhizosphere of Wetland Plants	88
6.4. An Explanation for the Development of Innate Metal Tolerance in Wetland Plants?	89
References	93
Chapter 7. Mycotrophy and Its Significance in Wetland Ecology and Wetland Management	
<i>A.G. Khan</i>	95
7.1. Introduction	95
7.2. Early History of Glomales	96
7.3. Evolution of Roots	97
7.4. Roots of Aquatic Plants	97

7.5. Mycotrophy of Aquatic Plants	97
7.5.1. Mycorrhizal Status	98
7.5.2. Plant Life Forms and Mycorrhizae	100
7.5.3. Relationships to Redox Potential	101
7.5.4. Relationship to Root Hairs	104
7.5.5. Relationship to P-Status (Oligotrophic vs. Eutrophic Status)	104
7.6. Significance of Mycotrophy in Wetland Ecology and Management	108
Acknowledgements	109
References	109
Chapter 8. Assessment of Risks to the Mai Po/Inner Deep Bay Ramsar Site due to Environmental Contaminants	
<i>P.K.S. Lam, M.H.W. Lam</i>	115
8.1. Background	115
8.2. The Mai Po and Inner Deep Bay Ramsar Site	116
8.3. Levels and Risks of Environmental Contaminants in Sediments	118
8.4. Levels and Risks of Environmental Contaminants in Biota	120
8.5. Recommendations	126
8.6. Overall Conclusion	127
Acknowledgements	128
References	128
Chapter 9. Modelling Contamination in an Urban Canal Sediment: Some Preliminary Results from a Phytoremediation Project	
<i>N.M. Dickinson, R. King, A. Royle, I.D. Pulford, W. Hartley, J. Jones, E. Gray-Jones, P.D. Putwain</i>	131
9.1. Introduction	131
9.2. Methods	133
9.3. Results and Discussion	135
9.4. Conclusions	139
References	140
Session III. Wetland Management Strategies in Asia	
Chapter 10. Conflicts in the Management of a Wetland Nature Reserve — Case Study of the Mai Po Nature Reserve, Hong Kong	
<i>L. Young</i>	145
10.1. Introduction	145
10.1.1. Geography	146
10.1.2. Ecological Importance	146
10.2. Management of the Inner Deep Bay Wetlands	147
10.2.1. Historical Management	147

10.2.2. Management Plan for the Mai Po Nature Reserve	148
10.2.3. Management Plan for the Ramsar Site	150
10.3. WWF Hong Kong Management of Mai Po	151
10.3.1. Vegetation Management	151
10.3.2. <i>Gei wai</i> Management	155
10.3.3. Freshwater Pond Management	157
10.3.4. Mangroves	158
10.3.5. Visitor Management	158
10.4. Summary	159
References	160
Chapter 11. Conservation and Uses of Mangroves in Hong Kong and Mainland China	
<i>N.F.Y. Tam</i>	161
11.1. Introduction	161
11.2. Mangrove Distribution and Characteristics in Hong Kong and Mainland China	163
11.3. Uses and Functions of Mangroves	164
11.3.1. Uses of Mangroves in the World	164
11.3.2. Functions of Mangroves in China	167
11.4. Conservation of Mangroves	169
11.4.1. General Principles	169
11.4.2. Conservation of Mangroves in HKSAR	170
11.4.3. Conservation of Mangroves in Mainland China	171
11.4.4. Mangrove Planting and Restoration	172
11.5. Problems and Possible Solutions in Mangrove Conservation	177
11.5.1. Habitat Loss Due to Land-Use Change	177
11.5.2. Water Pollution and Human Disturbance	177
11.5.3. Lack of Ecological and Baseline Data	178
11.5.4. Insect Infestation and Exotic Species Invasion	178
11.5.5. Insufficient Resources and Lack of Integration Between Various Departments	180
References	181
Chapter 12. An Integrated Analysis of Sustainable Human–Water Interactions in Wetland Ecosystems of Taihu Lake Basin, East China	
<i>D. Hu, J.S. Yan, T.X. Liu, G.W. Chen, S.J. Yuan, R.S. Wang</i>	183
12.1. Some Background Details of the Taihu Lake Basin	183
12.2. Concepts and Methodology for this Research	185
12.2.1. Basic Concepts	185
12.2.2. The Methodology of Research	185
12.3. Hydrology, Water Resources and Water Disasters in the Taihu Lake Basin	187

12.3.1. Hydrology in the Taihu Lake Basin	187
12.3.2. Water Resources in Taihu Lake Basin	189
12.3.3. Water Disasters in the Taihu Lake Basin	195
12.4. Water Quality Changes in the Taihu Lake Basin	197
12.4.1. Pollution Sources from Urbanization and Industrialization	197
12.4.2. Present State of Water Quality in the Taihu Lake Basin	199
12.5. Driving Forces for Changes in the Taihu Lake Wetlands Ecosystems	202
12.5.1. Driving Forces for Water Resources Changes	202
12.5.2. Driving Forces for Water Security Changes	203
12.5.3. Driving Forces for Water Environmental and Aquatic Ecosystem Changes	204
12.5.4. Driving Forces of Engineering for Wetland Ecosystem Changes	206
12.5.5. Driving Forces of Management for Wetland Ecosystems Changes	209
12.6. Integrated Human Responses to Building Sustainable Security for Ecosystems of the Taihu Lake Basin	209
12.6.1. Human Responses I (Water Resources): Sustainable Development and Uses of Water Resources	209
12.6.2. Human Responses II (Environment): Protection of the Water Environment	211
12.6.3. Human Responses III (Wetland Ecosystems): Improving Structure and Function of Wetland Ecosystems, Rehabilitating Disturbed or Destroyed Ecosystems, and Improving Their Ecological Capacity of Services	215
12.6.4. Human Responses IV (Wetland Ecosystems Engineering)	215
12.6.5. Human Responses V (Ecosystems Management): Building a Modern Ecological Culture for Realizing the Sustainable Management of Wetland Ecological Security	215
12.7. Conclusions	218
Acknowledgements	219
References	219
Chapter 13. Ecological Benefits of Italian Poplar Afforestation in Wetland Areas along the Yangtze River, Fanchang County of Anhui Province	
<i>Z.J. Xi, D. Hu, R.X. Wang</i>	221
13.1. Introduction	221
13.2. The Wetlands along the Yangtze River, Fanchang County	222
13.2.1. General descriptions	222
13.3. Characteristics of Wetlands in the Floodplain Areas	224