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湿地恢复手册

原则 · 技术与案例分析

The Wetland Restoration Handbook
Guiding Principles and Case Studies

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湿地是极其重要的生态系统，人们通常都把湿地与森林、海洋并称为地球三大生态系统。湿地拥有独特的生态功能，并且在抵御洪水、蓄洪防旱、降解污染、净化水质、涵养水源、调节气候、保护生物多样性等方面有着其他生态系统不可替代的作用和功能。湿地还是自然界中生物多样性最丰富的生态景观，也是各类珍稀濒危水禽的繁殖地和栖息地。因此，湿地被誉为“地球之肾”，又被称为“生命之源”。健康的湿地生态系统，是国家生态安全的重要组成部分和经济社会可持续发展的重要基础。保护好湿地对于维护生态平衡、改善生态状况、促进人与自然和谐、实现经济社会可持续发展，都具有十分重大的现实意义和深远的历史意义。

据专家研究，历史上，我国的湿地总面积曾经达到过6570万 hm^2 ，占我国国土总面积的7%。全国首次湿地资源调查表明，今天，我国湿地总面积为3848万 hm^2 （未包括水稻田3800万 hm^2 ）。其中，自然湿地面积3620万 hm^2 ，库塘湿地面积228万 hm^2 。自然湿地在国土面积中的比例仅为3.77%，远低于全球6%的平均水准。我国现存湿地的生态状况不容乐观，还有约40%的湿地面临着严重退化的危险；全国湿地面积减少、功能下降的趋势仍在继续，湿地生态系统面临着严重的威胁。据专家测算，50年来我国因围垦、改造等各种人为活动，丧失了至少40%以上的自然湿地，其中绝大部分是生态功能最为强大的沼泽湿地、湖泊湿地和滨海湿地。由于湿地面积减少和功能下降，我国湿地在保持水源、净化水质、蓄洪防旱、调节气候、维护生物多样性、抵御海啸和风暴潮危害等重要生态功能大大下降，一些重要的湿地文化和美学价值正逐步丧失，经济效益明显降低。从全球湿地保护的的经验来看，要做好湿地保护，必须恢复和扩大湿地保留面积、逐步恢复湿地生态功能。

湿地生态恢复在我国尚处于起步阶段，目前缺乏十分成功的技术和实例，这严重制约了我国湿地生态恢复工作的推广。一些科学家根据中国湿地生态系统的状况，提出应该通过努力将自然湿地在国土面积中的比例从现在的3.77%提高到6%左右，再加上人工湿地，这一比例将提高到10%左右，这样才能满足生态环境改善的需要，实现人与自然的和谐相处，提供良好的生态服务。要实现这个目标，湿地保护和恢复的任务非常艰巨，需要各级政府、各有关部门、国内外自然资源保护组织和所有关注湿地保护的人们共同努力。

开展湿地恢复，就要选择合理有效的技术和方法，以达到在最短时间内，用最少的资金和最合理的技术手段恢复最多的湿地。基于这种考虑，国家林业局湿地保护管理中心（中华人民共和国国际湿地公约履约办公室）和美国易道公司（EDAW），决定合作编写《湿地恢复手册》，在介绍全球湿地恢复成功案例的基础上，结合中国国情，为中国湿地生态的恢复提供技术指导与帮助。

国家林业局是中国组织协调全国湿地保护工作的政府机构，全面掌握中国湿地保护和恢复，具有丰富的湿地保护管理经验。美国易道公司是全球最大的土地和环境规划设计公司之一，在全球范围内接受过诸多景观设计、生态环境和湿地规划项目，实施了许多湿地恢复的成功案例。双方联合编写《湿地恢复手册》是强强联合。《湿地恢复手册》详细介绍了湿地恢复的关键技术和操作方法，汇集中外湿地保护恢复专家的科研成果，对中国及美国、欧洲、东南亚的湿地恢复成功案例进行分析，并根据不同类型湿地提出具有针对性的恢复和修复方案，科学性、专业性较强，对规范和指导各地开展湿地保护和恢复工程具有较强的指导作用，对我国湿地保护恢复工作具有重要意义。

《湿地恢复手册》是中外专家智慧的结晶，凝聚了众多湿地保护工作者的辛勤成果，在此我代表国家林业局对中外专家付出的努力表示衷心的感谢，同时也希望此手册为我国湿地生态恢复工作起到应有的作用。

赵学敏

国家林业局副局长
2006年8月

Wetlands, together with forests and oceans, are one of the Earth's three great ecological systems. The diversity of their utility can hardly be overstated. Wetlands play an indispensable role in fighting floods, balancing hydrologic and climatic cycles, protecting biological diversity, controlling pollution, minimizing the impacts of drought, and conserving water supplies. As one of the most biologically productive ecosystems on the planet, they are a paradise to rare waterfowl and are often referred to as "the cradle of life", and "the kidneys of Earth".

Given this context, it is easy to see why wetlands are a critical part of China's diverse ecology, one which can aid in the sustainable development of the nation's economy and contribute to the society's well being. Wetland conservation has a great contemporary significance for a country developing as rapidly as ours. Within them can be found factors that have long-term implications for maintaining ecological balances, improving environmental quality, and enhancing the harmony between mankind and nature.

The country's first survey of national wetland resources has shown that historically there was a total of 65.7 million hectares of wetlands covering, or 7% of the total area of China. It is estimated that today the total area of China's wetlands is 38.48 million hectares (this excludes 38 million hectares of rice fields), with natural wetlands covering 36.2 million hectares, and constructed wetlands covering 2.28 million hectares. Yet natural wetlands account for only 3.77% of China's total land area, well below the global average of 6%. The current ecological condition of China's wetlands is far from optimistic: 40% of remaining wetlands face a serious threat of degradation. The retreat of wetlands and the subsequent decline of their natural functions on a national scale present grave challenges to China. According to expert surveys, mining, construction and other human activities, have caused the destruction of more than 40% of the natural wetlands over the past 50 years, including many with the highest ecological values, such as swamp, lake and coastal wetlands. While critical ecological functions and economic benefits remain in decline as a result, important culture and aesthetic

values have already vanished. Drawing upon the growing variety of experiences of global wetland conservation, it is imperative that China restore and expand its wetland reserves, through a concerted attempt to restore their diverse ecological functionality.

Wetland restoration in China remains in the early stages. A lack of approved technology and successful case studies have hindered the promotion of wetland restoration. Considering the present condition of China's wetland ecosystems, some scientists have recommended that in order to attain the kind of environmental improvements that offer a better balance between humans and nature, the percentage of natural wetlands covering China's total land area should be increased from 3.77% to approximately 6%, or up to 10% if constructed wetlands are included. To reach this goal, there is a great deal to be done in the conservation and restoration of wetlands. Governments and their departments at all levels, along with international and domestic organizations that concern themselves with natural resources protection, and all who deeply value wetland conservation should join forces in a concerted, consistent effort.

China will be able to make the most of an "economy of protection" in recovering wetlands only if it chooses effective restoration technologies and approaches. This publication has that aim in mind. The State Forestry Bureau of China along with environmental planners from the firm EDAW conceived the idea of co-publishing the Wetland Restoration Handbook to introduce successful case studies on global wetlands restoration, and to offer the best technical guidance and solutions, with a book that is additionally sensitive to the particular needs of China.

The State Forestry Bureau of China is the official organization coordinating nation-wide wetland conservation activities. With the best management experience in wetland conservation and restoration, it controls detailed data and information in this field. EDAW is one of the largest land and environmental-based planning and design firms in the world. It has engaged in landscape designs, ecological environment

and wetland planning projects, and has implemented successful wetland restoration projects in China and across the globe.

The Wetland Restoration Handbook explains in detail key technologies and approaches to wetland restoration, bringing together scientific research and outcomes from foreign and domestic experts. It examines successful cases on wetland restoration in America, China, and Southeast Asia, and offers professional restoration and recovery technologies for various types of wetlands. This handbook aims to act as a definitive reference for our national wetland conservation and recovery effort.

A handbook of this kind has been a long time coming. As a representative of the State Forestry Bureau, I would like to thank all the professionals and their great efforts and contributions to this book. It is my hope that the handbook fulfills its purpose and produces the kind of results that will make China an example of a thoughtful stewardship over its vital natural resources.

赵学敏

Zhao Xuemin
Deputy Director General
State Forestry Bureau of China
August 2006

国家林业局和易道公司首开先河，联手打造出这部《湿地恢复手册》，旨在为中国的湿地保护事业提供实用的蓝本和参考。本《手册》反映了全球对可持续发展的环境设计与规划的呼吁，也表明了中国信守此原则的决心，同时见证了中国正越来越多地加入到关于有效环境管理的国际性对话中。

《湿地恢复手册》是一部专业著作，涵括了全球关于湿地资源保护和修复的重要论述；同时它也是一部符合时代要求的作品——将西方和亚洲的广泛经验与中国可持续发展的目标结合起来。这个宏大的目标定位需要政府、社会和个人的努力和支援，同时也给我们这个行业提供了绝佳的机遇。值得骄傲的是，易道公司与国家林业局的合作最终促成了《湿地恢复手册》的诞生。

本《手册》得以成书是许多人精诚努力的结果，限于篇幅，这里不能一一尽数。谨借此机会特别感谢国家林业局野生动植物保护司司长卓榕生和国家林业局湿地保护管理中心全体同仁，感谢他们在湿地保护事业上的持续努力，为中国的环境发展所做出的贡献。此外，还要感谢易道的亚洲区主席乔全生先生(Sean Chiao)，他的远见促成了本书的出版；还有亚洲区环境规划总监艾思龙先生(Stephane Asselin)，他在创建和恢复湿地方面的丰富经验为本书提供了宝贵的素材。

最后，谨将此书献给戴立亚先生(Sandy D'Elia)，以缅怀他为易道亚洲区的成长作出的宝贵贡献，以及他对中国的可持续发展的深厚信心。



乔·布朗
易道公司总裁CEO

The Wetland Handbook is the result of a ground-breaking collaboration between the State Forestry Administration (SFA) of the People's Republic of China and EDAW. That this joint effort was undertaken to create a practical blueprint and reference for wetlands conservation in China testifies not only to the global call for environmental and sustainable design and planning, but to China's commitment to those principles. The handbook is further evidence of China's deeper participation in the critical international dialogue for a responsible environmental stewardship.

The Wetland Handbook is a collection of some of the best examples of global expertise on conserving and rehabilitating the Earth's wetland resources. It also represents a unique moment where lessons learned in the West and Asia intersect with China's goals for a sustainable future. This rare alignment of goals requires political, social and individual champions and provides a great opportunity for our profession. We are proud that this opportunity with the SFA has led to a definitive statement through the Wetland Handbook.

This book is the result of the hard work of many people, too numerous to name. I would like extend special thanks though, to Zhuo Rongsheng, Director General for the Department of Wildlife Conservation, of the SFA of the People's Republic of China and to the staff of the Conservation and Management Center for Wetlands of the SFA, People's Republic of China, for their dedication to advancing an environmentally responsible vision for China through their efforts on wetland conservation. I would also like to thank EDAW's regional director Sean Chiao, whose vision provided the instrumental spark for the publication, and to EDAW Asia's environmental director Stephane Asselin, whose years of experience in creating and restoring wetlands can be found in the pages of this book.

Finally, the Wetland Handbook is dedicated to Sandy D'Elia, an early proponent for EDAW in Asia who brought his considerable energy to building our regional practice, and who was a dedicated believer in China and its vision for a more sustainable future.



Joe Brown, FASLA
President and Chief Executive Officer, EDAW Inc.



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第一章
Chapter 1

湿地及湿地恢复
Wetlands and Their Restoration

1.1	引言	Wetland Restoration: An Introduction
1.2	湿地的分类	Wetland Classification
1.3	湿地的价值	Wetland Values
1.3.1	生态与环境价值	Environmental Values
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1.5.1	沼泽湿地	Restoration of Marshes
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1.5.3	河流湿地	River Restoration
1.5.4	滨海湿地	Restoration of Coastal Wetlands
1.5.5	人工湿地	Artificial Wetlands



1.1 引言

湿地是位于水域和陆地之间的生态交错区，可以控制水域对陆地的侵蚀，对化学物质具有高效的处理与净化能力，还能够提供滨海咸水、河口或淡水栖息地。湿地是一道天然屏障，也是多种生物的避风港，其价值远远高于人们最初的认识。例如，尽管淡水湿地仅占地球表面的1%，其中的生物物种却占地球上总量的40%，湿地的价值由此可见一斑。湿地不仅具有不可替代的生态效益和防洪功能，也是环境保护中不可或缺的一个组成部分。

然而，当今全世界各地的湿地都处于不断退化或即将退化的厄运中（见图1-1, 1-2）；与此同时，科学家和专业人士也正在为湿地的保护、恢复与建设而坚持不懈地努力着。

近年来，湿地恢复领域发展迅速，这主要归功于一些大型湿地恢复工程的实施，例如美国佛罗里达州大沼泽湿地(Everglades Wetland)项目和旧金山市湾盐湖(San Francisco Bay Salt Pond)转化工程。在相对较短的时间内，中国也向保护和恢复湿地生态系统迈出了第一步。虽然湿地恢复在美国和大多数西方国家已经是成熟的做法，并继续向复合型专家协作模式发展，但是在其他的地方，湿地恢复尚处于探索的新兴阶段。值得一提的是，尽管湿地恢复在美国不断增长的环境事业中已经是其中常见的部分，然而十年前的情况却远非如此，并且，美国的湿地恢复发展到今天也曾经走过不少弯路。

从非洲到东南亚、美国、欧洲，世界各地的湿地都面临着相似的问题，同时，每个地区又有不同的情况和背景，有许多不同的影响因素。在中国，随着经济的迅猛发展和城市化进程急剧推进，许多地方已然出现自然环境急剧恶化的问题。

尽管如此，湿地恢复正迅速成为中国许多新开发专案和环境工程的重要战略，这一趋势还将延续数十年。而且，湿地数量和品质的恢复有望成为衡量中国环境工程的指标，不仅是开发过后的环境补偿，更是可持续发展进程的重要组成部分。

1.1 Wetland Restoration: An Introduction

Wetlands are natural water systems that contain erosion and prevent the degradation of tidal ecosystems. They also act as highly effective treatment and cleansing harbors for chemical runoff. Wetlands can be saline and coastal, estuary, or freshwater habitats. As natural barriers and a critical harbor for extensive biodiversity, they are invaluable. A testament of their worth can be found in the fact that while freshwater wetlands cover approximately one percent of the Earth's surface, they hold over 40% of the world's species. In addition to being flood barriers with irreplaceable ecosystems, wetlands are also, as many have come to agree, an essential feature in the business of environmentalism.

However, the story today of wetlands the world over is one of consistent degradation or the danger of degradation almost everywhere they exist. At the same time, significant talent and industry is being applied by scientists and professionals towards the restoration, protection and engineering of wetlands.

The field of wetland restoration has developed rapidly in recent years, most notably in the United States, due in large part to the implementation of ambitious restoration efforts such as the Everglades restoration programs in Florida and the San Francisco Bay Salt Pond Conversion in California. In a relatively short period, China is also undergoing a nascent move towards protecting and creating wetland habitats. While wetland restoration is a more mature practice in the US and most Western countries, one which continues to evolve into a complex collaboration of specialists, outside the US it is an emerging practice in search of greater structure. It should be noted that while restoration projects in the US are now common features of a growing environmental business, this was not the case even a decade ago, and achieving this status has been a process marked by its share of missteps.

While wetlands from Africa to Southeast Asia, to the US and Europe face similar challenges, each region has its own unique context that creates different factors. In China, an ascendant power undergoing one of the most intense urbanizations and economic growth, one unwelcome result has been the rapid degradation of the natural environment.

Wetland restoration though, is fast becoming a critical strategy for many new developments and environmental projects across China. This trend will evolve for decades to come and wetlands are likely to become standard features in environmental projects in China, serving not only as environmental compensation in the wake of development, but serving the larger end of a progress that is sustainable.



◀ 图 1-1: 湿地遭到破坏的原因经常是人为的干预，例如：围垦(摄影：何文珊)

Figure 1-1: Wetland degradation often results from human disturbance, such as this land reclamation operation in Hangzhou Bay, China (Photograph by Wenshan He)



◀ 图 1-2: 受到侵蚀的滨海湿地(摄影：Rowan Roderick-Jones)

Figure 1-2: Erosion of a coastal mudflat in Hangzhou Bay, China (Photograph by Rowan Roderick-Jones)

湿地的影响意义深远，能够改善生活品质，提供生态、休闲娱乐和社会文化价值。中国对湿地价值的认识日渐形成共识，而且，在湿地保护与恢复领域拥有广泛的国际基础经验作后盾——有越来越多的专业技术和相关立法可以借鉴，许多学者、规划师和专业人士都曾访问过国外许多著名的湿地恢复项目。

迄今为止，介绍湿地恢复的书籍不计其数，但是这些书籍主要针对美国的情况，几乎没有一本结合国际背景进行实用案例研究。本《手册》概述了湿地恢复的理论，辅以正在或已经在美国、欧洲、东南亚及中国实施的案例来加以说明。

湿地恢复这门学科自出现以来，业界和学术界从未停止对其实际作用的关注，不断分析总结20多年来湿地恢复项目中的成败经验教训。这些专案提供了很多宝贵资料和资讯，但是，中国和美国过去都未曾给予足够重视。因此，本书借此契机整合利用世界上主要的湿地项目，从方法入手，找出其中的共性，确立适用于不同国家相似情况的合理框架。

尽管生态的、工程的和湿地研究方面的出版物越来越多，但是专业人士发现在理论和实践之间还存在着一定的差距。希望本书能填补这个空缺，能够为决策者、工程师和工商界，甚至为研究者们提供一本权威、实用的手册。

本书的理念是给国内或其他国家和地区读者，提供实用的基础知识，并结合全球重要的湿地恢复工程进行个案研究。本书作者中有生态学家、工程师、水文学家、水质专家、经济学家和湿地景观专长的设计师等，他们的理论知识与实践经验被综合进这本实用手册中，因此，本书不仅能为业内专业人士和政府部门提供参考，也能为大众更多地了解湿地与湿地保护、湿地的生态功能及社会功用提供帮助。书中收录了国际上有关湿地恢复的实践经验，为中国的湿地恢复事业提供了一个通用的结构框架，旨在履行将先进的理念及技术应用用于保护

Wetlands create far-reaching opportunities that touch on areas such as improving the quality of life, and providing ecological, recreational, social and cultural benefits. The emerging consensus on the value of wetlands in China is abetted by a broader international awareness: Chinese in the field are increasingly exposed to international restoration projects and related legislation. Many top academics, planners and professionals have had access to some of the world's best known wetland restoration sites.

Numerous books have been written as "how to" guides on wetland restoration, primarily in the US. Few of these though, have included practical case studies in an international context. The Wetlands Handbook was conceived along the latter lines, aiming to provide an overview of the theory of wetland restoration, complete with illustrated case studies as they are being or have been implemented in the US, Southeast Asia and China.

Wetland restoration remains a discipline in which professionals and academics are monitoring project performance, analyzing what has succeeded and failed for projects that date up to 20 years ago. These cases provide invaluable data and information that has been largely overlooked not only in China, but also in the United States. As such, there is an opportunity to aggregate and leverage this knowledge using key wetland projects from around the world, to find consistencies in methodologies, and to create a streamlined framework that suits similar situations in different countries.

Yet even those most committed to that task can still find an unfortunate gap between theory and practical learning gained from the implementation of wetland projects, despite the greater availability of published material on ecology, engineering, and advances in related wetland research. That there remains a need for an authoritative, practical manual serving the broad interests of policy-makers, engineers and the business community, is a chasm that this book hopes to fill.

The idea is to present a common, critical foundation of knowledge, regardless of national or regional differences. The Wetlands Handbook integrates theory and practice, explained through case studies on important wetland restoration projects from around the world. While this book has technical aspects that are intended for professionals, scientists, academics and officials with at least some knowledge of wetlands, it will also appeal to the lay reader who would like to know more about wetlands and their preservation, their diverse ecological functions, and the roles they play in society.

By combining the ideas and experiences of ecologists, engineers, hydrologists, water quality specialists, economists

自然环境的责任。

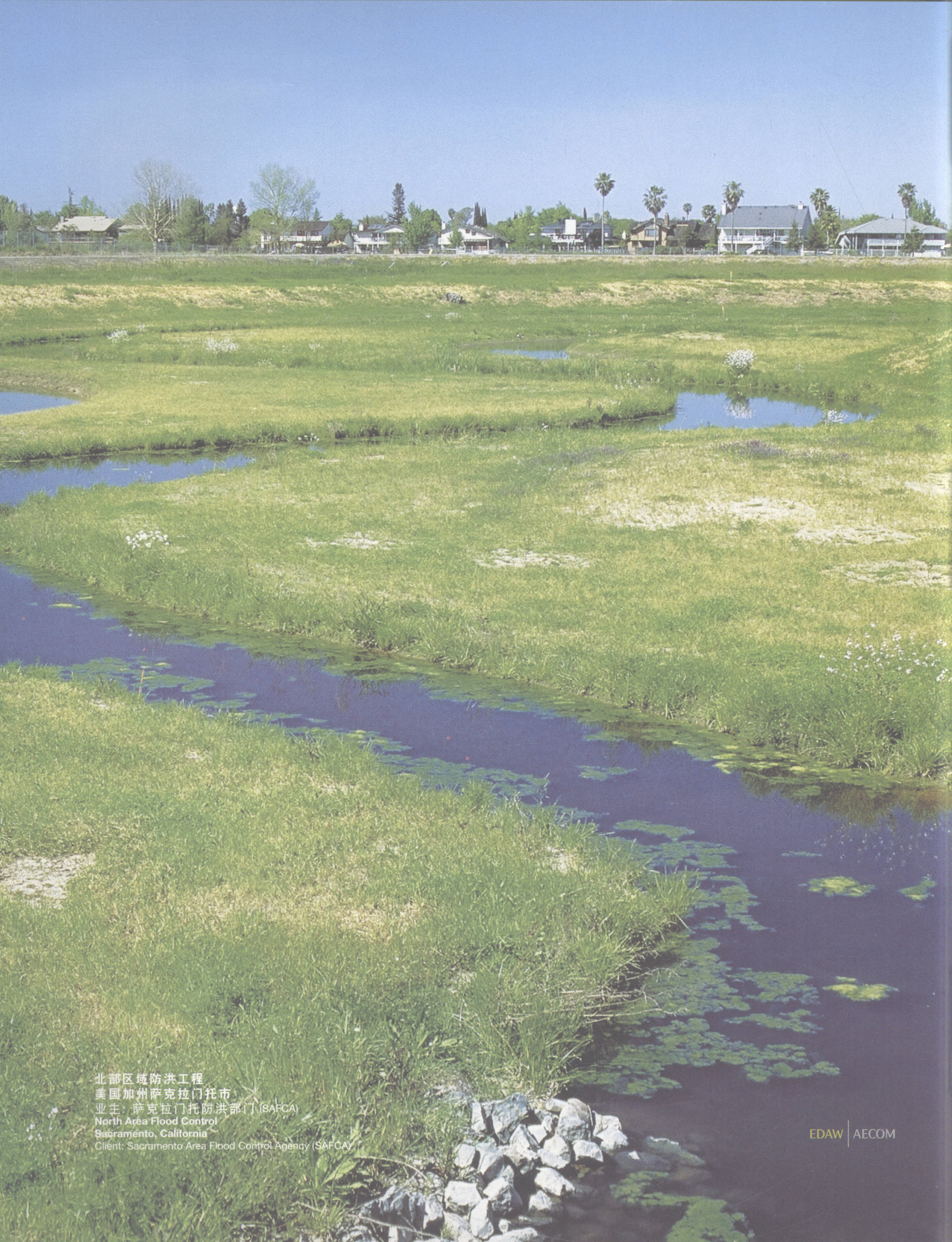
谨向多位湿地恢复领域内的专家致谢，感谢他们无私的参与，提供了湿地恢复中的丰富经验，使本书最终得以成稿。

and landscape architects on wetland restoration, the authors have compiled a highly practical reference book that contains the best international practices of wetland restoration, providing a common framework for wetland restoration efforts in China. While its approach is innovative, it is one attempt in the greater goal of applying better science and methodologies towards the duty that is the protection of the natural environment.

Finally, this book was made possible by the generous participation of many experts in the field of wetland restoration and relies on their documentation of these experiences – both successful and unsuccessful.

▼ 图 1-3: 湿地分类的不同依据(摄影:何文珊)
Figure 1-3: Factors influencing wetland character (Photographs by Wenshan He)





北部区域防洪工程
美国加州萨克拉门托市
业主：萨克拉门托防洪部门 (SAFCA)
North Area Flood Control
Sacramento, California
Client: Sacramento Area Flood Control Agency (SAFCA)

EDAW | AECOM

1.2 湿地的分类

从高原到河谷，从内陆到近海，湿地在地球上几乎无处不在。如果从字面上解释的话，无论是英文还是中文，“湿地”（wetland）一词都很容易被认为是“潮湿的土地”。事实上，潮湿的土地只是众多湿地类型中的一种，一些季节性湿地在旱季时可能非常干旱，一年中有几周或几个月的干涸期；而湖泊和海草床等湿地生态环境则终年被淹没在水下。不同的国家和专业组织对湿地有不同的定义，目前全球广泛引用的是1971年在伊朗拉姆萨尔小城签订的《湿地公约》中第1.1条款关于湿地的定义：

“湿地系指天然或人工、永久或暂时之静水流水、淡水、微咸或咸水沼泽地、泥炭地或水域，包括低潮时水深不超过6m的海水区。”

根据此定义，湿地包括多种类型，泥炭地、沼泽地、河流、湖泊和红树林生态系统，甚至珊瑚礁都属于湿地。和所有自然生态系统一样，湿地不属于任何现成类别，湿地的许多特征不符合环境梯度，使其类别很难界定。影响湿地特征的最重要因素是水文和水文周期；其他有助于湿地分类的重要环境参数有：盐度、水流状态和植被类型（见图1-3）。

除了天然形成的湿地外，还有人工湿地。在《湿地公约》分类系统中，人工湿地也叫人造湿地，包括养殖池塘（见图1-4）、潮湿的农田（如水稻田）（见图1-5）、盐业用地、蓄水用地、运河和废水处理区。

历史上，人工湿地是对自然生态环境的改造，目的是为满足一些明确需求，如食物生产、饮用水供应或交通需求，从而为当地群众带来切实的利益。近来，无论是专业人士还是普通大众，在建设用作其他用途的湿地方面都具有越来越强的意识，如用于提供生态价值、洪水控制功能乃至文化和宗教用途。湿地建造与恢复项目越来越多地被用于提供各种环境和社会功能，而不是简单的经济效益。

1.2 Wetland Classification

From high plateaus to river deltas, to continental interiors and coasts, there are few places on Earth where wetlands do not exist. In both English and Chinese, the word 'wetland' is often taken literally to mean wet landforms. However, 'wetlands' as such are only one of many kinds of wetlands. There are ephemeral or seasonal wetlands, which are dry for all but a few weeks or months during the year. Other wetland habitats such as lakes and seagrass beds are consistently inundated with water. Moreover, wetlands are defined differently in various countries and organizations. Currently, the most commonly adopted definition is that given in Article 1.1 of The Convention on Wetlands (Signed at Ramsar, Iran in 1971, and commonly known as the Ramsar Convention):

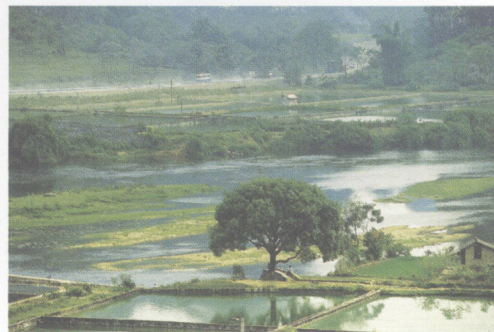
"For the purpose of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres."

As noted above, wetlands can include peatland, marsh, river and mangrove habitats, and even coral reefs. As with all natural habitats, wetland types do not fall into convenient discrete categories, but instead have characteristics that vary along environmental gradients, making them difficult to classify. The most important factor influencing wetland characteristics is hydrology and hydroperiod. Other critical environmental parameters that help classify them include salinity, water flow, and vegetation types (Figure 3).

In addition to naturally occurring wetland habitat types, there are also man-made habitats that are defined as wetlands. Man-made wetlands classified under the Ramsar Convention include aquaculture ponds, 'wet' agricultural land (such as rice fields), salt pans, water storage facilities, canals and wastewater treatment areas.

Historically, man-made wetlands have been modified natural habitats, created in order to meet a clear demand such as food production, drinking water supplies, or transportation requirements, bringing tangible benefits to local communities. More recently though, there has been a growing awareness on the part of both professionals and the general public in creating wetlands that serve other purposes, such as providing ecological value, enhancing flood control abilities, and even serving cultural and religious purposes. Wetland creation and restoration projects are increasingly being designed to provide a whole range of environmental and social benefits, rather than simple economic gain.

▼ 图1-4: 养殖鱼塘 (图片来源: www.photos.com)
Figure 1-4: Fishery ponds (Source: www.photos.com)



▼ 图1-5: 亚洲南部常见的稻田 (图片来源: www.photos.com)
Figure 1-5: Rice fields are common sites in southern Asia (Source: www.photos.com)



1.3 湿地的价值

1.3.1 生态与环境价值

生态价值

湿地是非常重要的生态资源，具有极其丰富的生物多样性。在美国，仅占国土总面积9.5%的湿地滋养着美国1/3的濒危物种，另有1/5的濒危物种在它们生活中的某个阶段会利用湿地。美国的湿地保护源于保护水禽及其栖息地的需要，因为许多禽类都在湿地里筑巢、觅食和栖息。很多大型河口湿地处于海陆交界、咸淡水交汇处，因此生境异质性强，生物多样性也更加丰富，是多种候鸟迁徙途中的重要驿站。

以位于长江口的崇明东滩鸟类自然保护区为例。近年来，每年冬季在崇明东滩越冬的雁鸭类达5万~6万只(徐宏发和赵云龙，2005)。其中珍稀保护鸟类有白鹤(*Ciconia ciconia*)、白头鹤(*Grus monacha*) (见图1-6)、小天鹅(*Cygnus columbianus*)、黑脸琵鹭(*Platalea minor*)和小青脚鹬(*Tringa guttifer*)等。湿地也是濒危鱼类的洄游必经之处，如中华鲟(*Acipenser sinensis*)等洄游鱼类，对长江及其河口具有极高的依赖性，避免进一步的栖息地丧失和破碎化是其种群恢复的关键因素(见图1-7)。

水文价值

水文价值是湿地生态价值的重要组成部分。在我国的东部省份，洪水是导致人员死亡和财产损失的主要自然灾害，据报

1.3 Wetland Values

1.3.1 Environmental Values

Ecological Value

Wetlands are an extremely important ecological resource, a fact demonstrated by their exceptional levels of biodiversity. In the US, for example, wetlands only cover 3.5% of the total land area, but support a third of all endangered species found in that region. Protection of wetlands originated in the US from the conservation of waterfowl and its habitats, with many bird species using wetlands for nesting, hunting food and shelter. Located at the interface between ocean and land, fresh water and salt water, large estuary systems often boast a rich biodiversity and a high level of biological productivity, and thus serve as important stopovers on the migration paths of many bird species.

The Natural Reserve for birds on the eastern end of Chongming Island for example, the total number of birds wintering at the site is in the range of fifty to sixty thousand, including many endangered species such as the White Stork (*Ciconia ciconia*), hooded crane (*Grus monacha*), Bewick's swan (*Cygnus columbianus*), the black-faced spoonbill (*Platalea minor*) and Nordmann's greenshank (*Tringa guttifer*). Wetlands are also vitally important for certain endangered fishes such as the Chinese sturgeon (*Acipenser sinensis*), which is highly dependent on the Changjiang River and its estuary. Avoiding further degradation and fragmentation of the habitat is essential for the conservation of these species.

▼ 图1-6: 在崇明东滩湿地越冬的白头鹤(*Grus monacha*)种群
(摄影:章克家)
Figure 1-6: Wintering population of hooded crane at Chongming Dongtan wetland
(Photograph by Zhang Kejia)



▼ 图1-7: 渔业产量常取决于湿地的品质
(摄影:章克家)
Figure 1-7: Many fishery products depend on wetlands
(Photograph by Zhang Kejia)

