

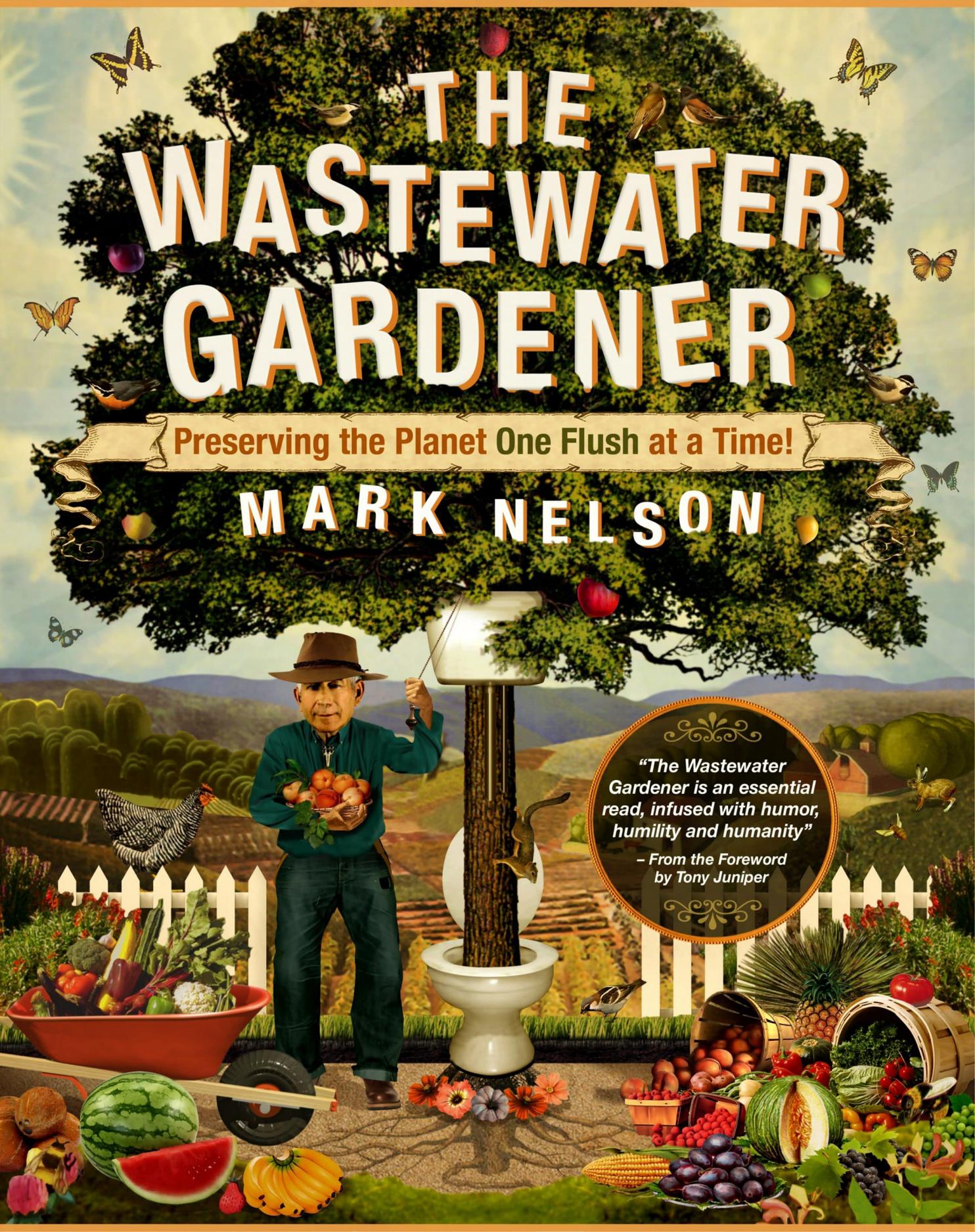
# THE WASTEWATER GARDENER

Preserving the Planet One Flush at a Time!

MARK NELSON

*"The Wastewater Gardener is an essential read, infused with humor, humility and humanity"*

*- From the Foreword  
by Tony Juniper*



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Published by Synergetic Press  
1 Bluebird Court, Santa Fe, NM 87508

The Wastewater Gardener © Mark Nelson, 2014  
Foreword © Tony Juniper, 2014

#### Library of Congress Cataloging-in-Publication Data

Nelson, Mark, 1947-

The wastewater gardener : preserving the planet one flush at a time! /  
Mark Nelson ; foreword by Tony Juniper. -- First edition.

pages cm

Other title: Preserving the planet one flush at a time!

Includes bibliographical references and index.

ISBN 978-0-907791-52-2 (hardcover) -- ISBN 978-0-907791-51-5 (pbk.)

1. Sewage irrigation. 2. Water reuse. 3. Sewage--Environmental aspects.

4. Gardening--Environmental aspects. 5. Constructed wetlands. I. Title.

II. Title: Preserving the planet one flush at a time!

TD760.N35 2014

2014009840

628.1'68--dc23

Cover concept by David Rogers.  
Cover art, illustrations and map by Jeff Drew  
Cover photo of author by Stephen Muller  
Book design by Ann Lowe  
Editors: Linda Sperling with Hugh Elliot

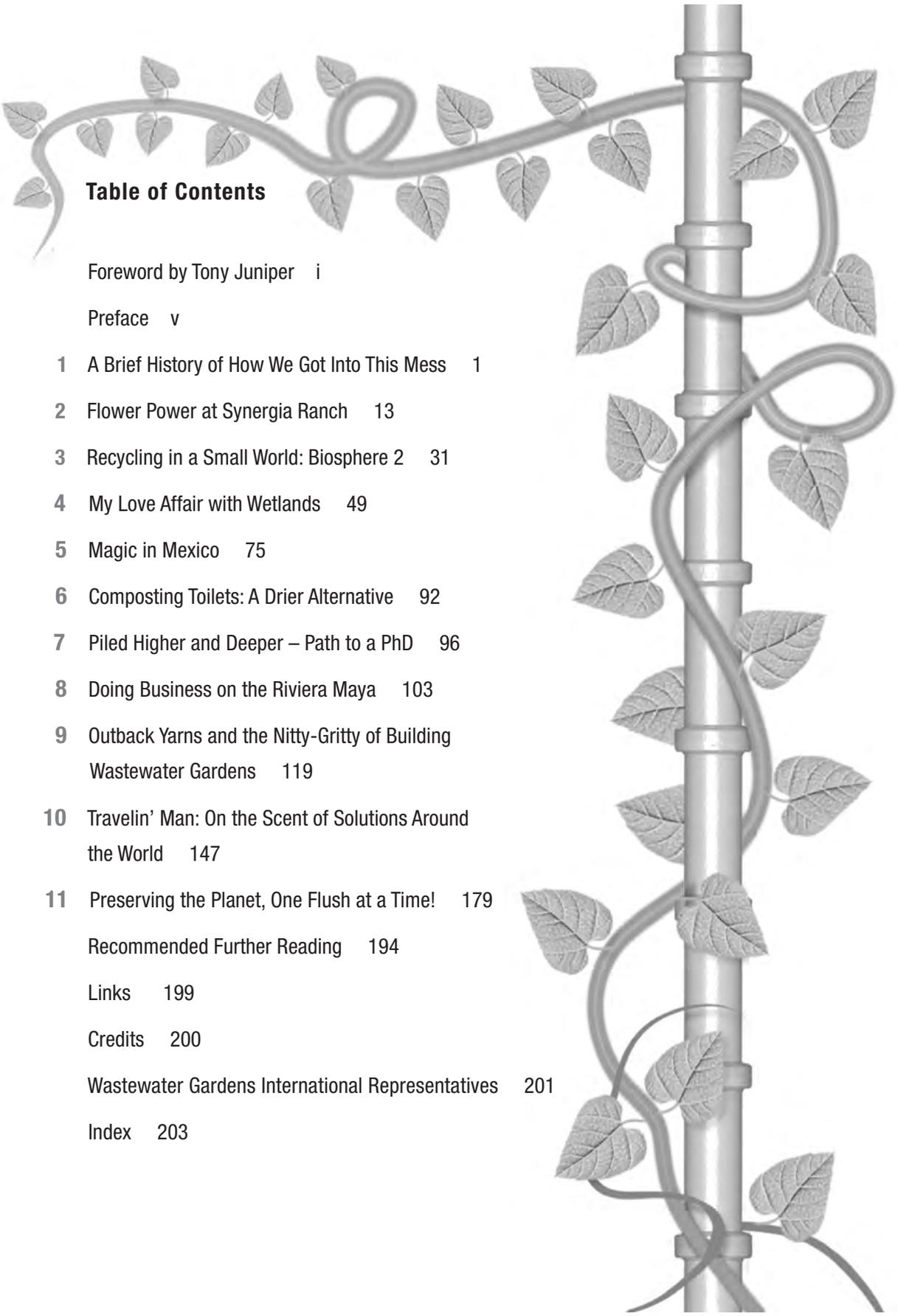
Printed by Friesens Printing, Canada

The text of this book was printed on 60# Husky Offset White 100% recycled post  
consumer waste paper.

Typeface: Adobe Garamond Pro and Helvetica Neue Condensed

This book is dedicated to Susannah Garrett, mi Fortuna,  
who makes me appreciate my *suerte* every day.





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# Foreword

**T**HERE ARE SEVERAL MODERN SYMBOLS of ecological crisis. Gas-guzzling vehicles, airliners, coal-fired power stations and landfill sites are among them. While few people would add flush toilets to the list, there is increasingly good reason to see why that might be the case.

Freshwater is one of those day-to-day necessities that many of us have become used to taking utterly for granted. Delivered clean and safe through pipes to homes and offices, it can seem like an endless resource that will always be easily available. Reality is somewhat different, however, for in a planetary sense freshwater is not as abundant as it can sometimes seem to be, far from it in fact.

Of the 1.4 billion or so cubic kilometers of water that we have on Earth, nearly all of it is in the oceans and therefore salty. About 97.5 percent of it is in that form. Of the remaining 2.5 percent that is fresh, some 60 percent is trapped in ice caps and glaciers with 30 percent more in groundwater, and therefore for the most part not immediately available to us for farming, domestic supply and industry. The tiny remaining amount that is generally renewable and in rivers, lakes, ponds and clouds, is subject to increasing

demand from more people living in larger, growing and ever more demanding economies. Not only is that little slither of freshwater under mounting pressure, its local availability is also subject to growing volatility because of changes taking place in the Earth's climate.

We go to great lengths to ensure that societies have enough freshwater, and each year spend billions of dollars on extracting it from the environment, putting it in reservoirs, cleaning it and then piping it to where it's needed. The precious resource to which we go to such lengths to supply is every day then turned into "wastewater" of different kinds, including by the simple act of flushing lavatories.

This convenience was of course invented for good reason and the sanitary engineers who during the nineteenth and twentieth centuries contributed to the rise of the modern toilet can correctly be seen as among those who helped build the healthy lifestyles so many of us enjoy today. They helped to reduce the spread of infectious disease and brought to the mainstream devices that would increase people's lifespans.

At the same time though, they introduced technologies that would require some ten thousand tons of water to remove and treat each ton of human excrement and lead each one of us with a flushing toilet to use in the order of ten thousand gallons of water a year to send our waste away.

Increasingly though, we are finding that in our shrinking world there is no "away." In the end all of our waste ends up somewhere, often contributing to different environmental problems when it arrives at its final destination. Considering the dual trends of rising demand for freshwater and the increasing amount of nutrients leaving our toilets building up in the environment, those problems will only become more complex. Fortunately though there are solutions, and in this marvelous book Mark Nelson shares his decades' long experience to explain what they are.

His basic conclusion is that by copying nature, and in particular how wetlands work, cost effective, healthy and sustainable alternatives to our wasteful sanitation systems can be put in place, not only defending us from the effects of water scarcity, but also protecting ecosystems from impacts that can be caused by too much of our bodily wastes being released into them. He takes readers on an inspiring journey, one that is rendered all the more impactful by his stories of doing it for real.

From Mexico to Western Australia and from Bali to Arizona, Nelson has designed and installed systems that have provided local sanitation solutions while bringing global benefit and his stories show how he's done it with humor, humility and humanity.

Painting a picture of how soils, plants and water might be harnessed in ways that meet our needs without pipes, sewage works and pollution, Nelson inspires us to see opportunities that are not only practical, but if designed well also beautiful. Channels of water flowing between willows, water hyacinths, lilies, rushes and cattails, with the cleaning function of roots and microbes harnessed in the purification of water, could almost not be more different from high-tech centralized wastewater treatment facilities.

The construction of beauty is, however, a very practical response and one predicated on the understanding that the excrement we do so much to get rid of is essential to life. All living things require nutrients to exist, grow and reproduce and the material we eject from our bodies and into sewers is a massive source of those life-giving materials. That we have lost sight of this basic reality and strive so hard to place ourselves outside nature is one further manifestation of the industrialized mindset that any rational reading of our direction of travel would suggest we need to change.

In common with others who present the kinds of durable solutions that are needed to deal with the multiple challenges that

confront us, Nelson describes how it is not only different treatment systems that are required, but also a shift in this unrealistic mindset. Especially through how we might see things differently by taking more of a system-based approach, compared with more reductionist ways of thinking that seek to deal with each problem at a time and in isolation from related ones.

Perhaps through the pages of this important book the flush toilet might one day become not only a symbol of unsustainable development, but also of the hazard that can accompany “solutions” that meet one challenge while not considering others. For while the flush toilet has been successful in protecting public health, it will, because of, among other things, progressive water scarcity, nutrient depletion and environmental impact, not be a solution that can lend itself to upwards of nine billion people.

This is why *The Wastewater Gardener* is an essential read for anyone with an interest in sustainable development, water, urbanization, sanitation and public health. For while it might seem that the only alternative to the open sewers that characterized so much of our past, and in too many places the present, is the installation of flushing toilets and building sewage works, there is in many cases a better way, one that brings not only health and sustainability, but also beauty. Infusing it all is the realization that nature does not do waste, and if we wish to endure, then neither should we.

—Tony Juniper

Environmentalist, Author, Fellow with the  
University of Cambridge Institute for Sustainability  
Leadership and Advisor to The Prince of Wales  
International Sustainability Unit

# Preface

“Anyone starting out from scratch to plan a civilization would hardly have designed such a monster as our collective sewage system. Its existence gives additional point to the sometimes asked question, Is there any evidence of intelligent life on the planet Earth?”

—G.R. Stewart, author, *Earth Abides*, 1949.

**T HIS BOOK HAD ITS GENESIS** the first time I tipped over an outhouse and shoveled the steaming contents into a wheelbarrow headed for the humanure compost heap. I was a city kid; I didn't know the stuff was taboo.

When I was selected to be a “biospherian,” that is, a crew member for the first two year closure experiment of Biosphere 2, it may have been destiny that one of my responsibilities was managing our “marsh recycling system” for all the wastewater. Later on, when I'd fallen in love with wetlands, both natural and constructed, I decided to make myself useful by confronting sewage problems around the world. That commitment led me from one improbable adventure after another to a veritable Wonderland of strange goings on. Fortunately, I held to my inner yoga and can testify that by keeping your optimism and belief you *can* make a difference, and never lose your sense of humor!

It occurred to me these “adventures in the shit trade” have more than purely humorous anecdotal value. I got to see what is hidden for good reason from most people, although it sometimes took persistence and detective work to find out what was really happening. I feel a responsibility to share with a greater audience what I have seen and

learned. As ecologists say, everything is connected to everything, and how we manage and mismanage our shit, is a crucial part of the global challenge of our times.

Conventional industrial-style agriculture doesn't use animal manure—we turn our farms into monocultures, raise our animals in factory settings, using lots of chemical fertilizers which are expensive, releasing greenhouse gases and nutrients run off from our farms in great quantities polluting our waters and oceans. In the West, we centralize sewage treatment—sending all sewage nutrients into our rivers and oceans, instead of back to our farms or green spaces. Rather than irrigate using graywater, we use precious, high quality potable water. In poorer countries, there is virtually no effective sewage treatment at all and widespread contamination of drinking water leads to disease, death and further impoverishment.

We all know the Hans Christian Anderson tale, *The Emperor's New Clothes*, in which only a child is honest enough to speak aloud of the emperor's delusion. This book is the global black comedy which unfolds when the little boy opens his eyes. I hope it changes the way you think about at least one of the so-called "little" things we do in life.

I gratefully acknowledge the many colleagues and participants whose efforts led to the creation of the work contained in this book. These include my Institute of Ecotechnics friends and teachers: in particular John Allen, a rare man who combines vision and common sense, and also Marie Harding, William Dempster, the late Robyn Tredwell, Margaret Augustine, Chili Hawes, Gerard Houghton, Kathelin Gray and Deborah Parrish Snyder.

My Wastewater Gardens International intrepid network of designers and regional representatives: especially Florence Cattin who made our Algeria work possible and brought the technology to new countries like Spain, Portugal, Morocco, the Maldives and some

parts of Indonesia; also Davide Tocchetto, Gonzalo Arcila, Ingrid Datica, Andrzej Czech, I Gede Sugiarta, Andrew Hemsley, Malini Rajendran and Lucien Chung.

I deeply appreciate the leadership and support of Abigail Alling and Mark Van Thillo of the Planetary Coral Reef Foundation through which we built the early Wastewater Garden systems in Mexico, West Australia, Bali and Sulawesi, Indonesia. The Foundation contributed significantly to the creation of Wastewater Gardens International and its network. And Emerald Starr whose passion for the environment helped make possible the many lush Wastewater Gardens flourishing in Bali and around the Bunaken Marine Reserve in Sulawesi. And our team in Mexico which included Gonzalo Arcila, Ingrid Datica, Reka Komaromi and Klaus Eiberle whose dedication and hard work led to building over 50 systems along the Yucatan coastline. At the University of Florida, the late H.T. Odum, Mark T. Brown, K. Ramesh Reddy, Clay Montogue, and Daniel Spangler taught me how to think in systems; working at their Center for Wetlands sparked the creation of new approaches to ecological engineering.

Wastewater Garden projects have received the kind support of many key people and organizations including Petra Schneider and IDEP Foundation, Indonesia, Seacology Foundation, the Livingry Foundation, the Sendzimir Foundation, the Puerto Rican Department of Natural Resources, Maurice Levy of Earth and Water, Portugal, Sheikh Mohamed Laïd Tidjani, head of the Tidjani Sufi order in Temacine, Algeria, the Algerian artist Rachid Koraïchi and the Association Shams, Abdelkader Belkacemi and Mohamed Sadaoui (Faouzi) from the Algerian Ministry of Water Resources, the Belgian Technical Corporation, Lamine Hafouda from the INRA station at Touggourt, Algeria, Juan José Salas Rodríguez from the Centro de las Nuevas Tecnologías del Agua of Andalucía and the PECC, Ben Brown of the

Mangrove Action Project, the World Wildlife Fund, David Carpenter at the Aboriginal Housing Division of the West Australian Department of Housing and the Australian Community Water Grants.

I wish to thank Sally Silverstone and Thrity Vakil, previous and present managers of Las Casas de La Selva who facilitated building our demonstration system in the heart of the sustainable tropical forestry project in Puerto Rico. And my colleagues in Australia: Robyn Tredwell who selected the native plants and *bush tucker* (food) plants for our systems on the Aboriginal communities in the Kimberley and who skillfully navigated our projects through uncharted political and cultural waters; and her team from Birdwood Downs Company of Greg Hay, Hans Leenaarts, Brad Riley and Eddie Zuna.

The visionary leaders at Nature Iraq, Azzam Alwash, Jassim Al-Asadi and Ammar Zakri, along with the gifted artist, Meridel Rubenstein, are helping realize our ground-breaking project, *Eden in Iraq*, with the Marsh Arabs in southern Iraq. Our design team also includes Prof. Sander van der Leeuw of Arizona State University and Prof. Peer Satikh of Nanyang Technological University (NTU). And thanks to NTU for a grant making possible our site visits and design work.

I am grateful to the publisher, Deborah Parrish Snyder, and Omar Fayed, president of Synergetic Press for seeing the importance of this book; and the Synergetic Press team: David Rogers, Debbie McFarland, Mitch Mignano, Melissa Guthrie and Graciela Ruiz for making this such a fun book. The surgical work of Hugh Elliot and Linda Sperling, my gifted and dedicated editors, is reflected throughout the book.

There's a saying in my Institute: "Beauty, Discipline, Honor and Friendship." May these be watchwords as we strive to remake the world a little closer to our heart's desire.

—Mark Nelson