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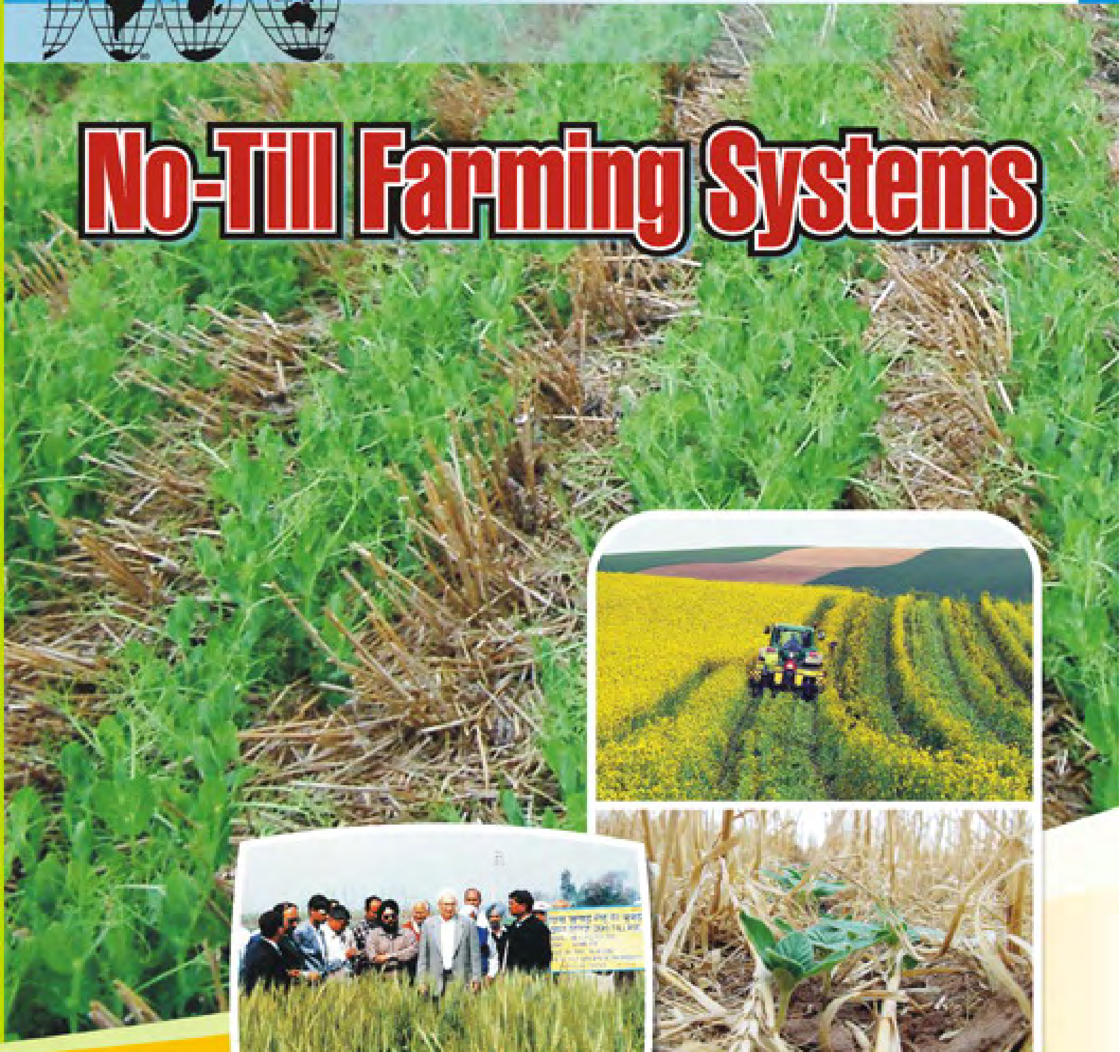
No-Till Farming Systems



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"Calendario Agrícola Incaico – Agricultural Calendar of the Incas"

Drawing by Phelipe Guaman Poma de Ayala, Peru; early 17th century

By courtesy of Rolf Derpsch, Conservation Consultant,
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NO-TILL FARMING SYSTEMS

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“No one has ever advanced a scientific reason for plowing.”

“There is simply no need for plowing in the first instance.
And most of the operations that customarily follow the plowing are entirely unnecessary, if the land has not been plowed.”

“There is nothing wrong with our soil, except our interference.”

“It can be said with considerable truth that the use of the plow has actually destroyed the productiveness of our soils.”

Edward Faulkner
From *Plowman’s Folly* (1943)

Foreword

Welcome to a very unique book: A truly global collection of information presented by farmers, extension specialists, discipline professionals and research scientists. The World Association of Soil and Water Conservation (WASWC) had become aware of the range of no-till farming systems around the world, and realized the need to share this information as widely as possible.

The practice of no-tillage crop production has flourished during the last few decades. It has now been adopted in some form in most countries. Such a ubiquitous phenomenon has few precedents in modern times. The evolution of no-tillage and its adoption rate have not been linear. Progress accelerated as the breakthroughs in science and new technologies gradually accumulated.

The pioneers of no-till had a difficult time. Most were inquisitive farmers skilled in practical problem solving and mechanics, and motivated to continually initiate new avenues of exploration. They could see the rationale behind the practice and the potential benefits from its application. But equipment was limited and of inadequate design for the wide range of applications required. And their knowledge of the complex production ecology of no-till systems was very limited. However, their enthusiasm was infectious, and others increasingly joined in the quest to make no-till farming practical and profitable.

The early practitioners and researchers were challenged by weed problems and fertility management. They soon came to realize that no-till practices create a moving target. The soil's biological, physical, and chemical properties all change over time, as does the composition of weed populations. It takes time for the soil and plant system to reach a new equilibrium. Long-term research was therefore required to unravel the puzzle. However, research grants were most often short term; hence the initial results and recommendations did not always coincide with longer-term field experience. Research scientists had problems trying to represent field conditions on small plots. And no single no-till suite of recommendations fitted all areas, so farmers had to conduct localized field trials to see what worked best in their region and for their particular cropping systems.

The continued evolution of no-till farming requires the sustained enthusiasm of all involved, including farmers, extensionists and scientists. New participants need to receive proper training and education in no-till farming techniques. Support at the national level is needed for no-till to continue to develop. Crop improvement trials need to be done under no-till conditions so that crop traits important to no-till are selected for. Likewise, fertility and agronomic practices need to be conducted on no-till managed land at the plot, field, and landscape scale to encounter the full range of production ecologies.

Research is venturing into new areas such as how innovative cropping systems and residue management can influence soil biological activity and nutrient cycling. Biological tillage is replacing mechanical tillage, and more attention is being given to cropping systems and agronomic practice to control weeds and replace the myopic view of ‘herbicides only’. It is the responsibility of all involved in no-till to ensure that such efforts continue into the future so that no-till can be adopted on a far greater scale across the agricultural systems of the globe.

This book aims to celebrate from where no-till has come, and to advance the concept by sharing the latest information and knowledge from around the world. New frontiers and the most recent developments are discussed. One of the most significant of these is the expanding interest in how carbon accumulation in agricultural systems can both enable greater adaptation to climate change and contribute to the mitigation of greenhouse gas emissions. The carbon markets are rapidly taking note of the vast potential for no-till systems to contribute to carbon offsets, thus opening up the opportunity for progressive farmers to gain additional income for their efforts to create more sustainable and productive no-till farming.

Dennis Garrity

Director General
World Agroforestry Centre
Nairobi, Kenya

Preface

No-till farming systems have been developed and applied around the world over several decades. The technology is dynamic: it develops and changes as we overcome obstacles in soil opening, seed placement, fertilizer banding and more. Researchers and farmers continue to modify the systems and apply no-till to a wider range of agricultural production systems. Benefits of no-till have been found in production, economic and environmental aspects of farming. As farmers apply no-till, their agronomic system moves to a new equilibrium. New investments in research of soils and plants are helping no-till to develop further.

We are not aware of any text that reviews global trends in no-till. Some texts review aspects of no-till from a particular standpoint. Those texts are often written by scientists engaged in lab or plot research or from the experience of a particular country. In this text we have not constrained the reporting to a scientific plot based experience, nor have we constrained it geographically. We have encouraged those with experience and expertise in no-till to tell us their stories, which span a broad range of perspectives, including farmer experience and beliefs as well as plot research. This book is the result of the contributions of 78 authors from 20 countries or regions, describing at least 25 study areas of all habitable continents – several of them in more than one instance. These authors possess roughly one thousand person-years of no-till experience!

Bringing so many contributors together from so many countries and constraining them to a common language of English presents its challenges. Some of these papers have been translated from their original language. Some expressions do not translate well.

There may also be regional terms for the same implement or practice. One example of this is a ‘harvester’ or a ‘combine’– two names for the same implement that harvests crops. Another is whether we call placing the seed in the soil ‘planting’ or ‘seeding’. We are of course accustomed to many of these synonyms; others are new. For the simpler terms (planting or seeding) we have not enforced a consistent style. For less common terms, we have attempted to provide a description of the term where the meaning is not evident from the context.

We have encouraged all experts in no-till to contribute, whether they are scientists or field-orientated professionals. We have therefore not required the standards of refereed journal publications such as referencing every claim beyond the immediate work, inclusion of statistical tests, and the substantiation of claims with references or data. You may also see preliminary data from early field trials, and the use of some less ‘scientific’ terms (e.g. soil health, soil nutrition) in some areas. Through these allowances we hope we have allowed the chapters to retain some of the passion of the writers.

We are therefore very optimistic and feel this book is a useful compendium of the state of no-till from all corners of the world that contains not only an objective review of experimental research, but passion and field observations that may serve academics, professionals and farmers as their companion in motivating and guiding them to continue their work of discovery.

The Editors
October 2007

Acknowledgements

How did it all begin?

In August 2004, as the WASWC President, I was invited by the Asociación Argentina de Productores en Siembra Directa (AAPRESID – Argentine No-Till Farmers Association) to participate in its 12th Congress in Rosario, Argentina, from which I had gained first hand knowledge about no-tillage in agriculture. Mr. Jorge Romagnoli, the AAPRESID President and Mr. Roberto Peiretti, an active Board member as well as President of CAAPAS (Confederación de Asociaciones Americanas por una Agricultura Sustentable – American Confederation of Farmers Organizations for a Sustainable Agriculture), had helped in every way to facilitate my learning of no-till farming practices.

After the meeting I traveled to Brazil where John Landers, Director of the Associaçao de Plantio Direto no Cerrado (APDC – the No-Till Association of Brazil), took me to Brasilia and the vast agricultural region of Mato Grosso do Sul State where many farmers successfully practiced no-till agriculture. Mr. Landers introduced me to many EMBRAPA Cerrados staff in Brasilia, while Dr. Antonio Ramalho helped to liaise with his EMBRAPA Solos in Rio de Janeiro. Discussions with EMBRAPA personnel in both offices provided me with invaluable information on the reasons why or why not Brazilians adopted no-till practices. EMBRAPA is a large Brazilian government agency dealing with agricultural research and development, employing thousands of staff all over the country.

When the idea of no-tillage crystallized in 2005, the WASWC Council agreed to adopt the topic as the subject of its next Special Publication (SP number 3). The authors invited at that time were Rolf Derpsch, Don Reicosky, José Benites, John Landers and Carlos Crovetto, all 'no-till gurus' of the Western Hemisphere, where the success of no-till was already recognized. Tom Goddard, WASWC National Representative for Canada, agreed to help edit the 150-page volume, which was given the working title *No-Till Farming Systems*.

At the same time, private sector companies were contacted to ensure that WASWC would be able to publish and distribute the book globally to those who really need it. The following firms kindly agreed to support the project: Syngenta AG, Basel, Switzerland; SEMEATO Farm Machinery Co., Passo Fundo, Brazil; Eijkelkamp Agrisearch Equipment, Giesbeek, The Netherlands; Donald Fryrear Custom Products and Consultants, Big Spring TX, U.S.A. and The No Tillage Development Center, Chequen Farm, Concepción, Chile. SonTek of San Diego also became involved at a later stage, the same as Mr John Burton of NJ, U.S.A.

Before the publication date, it was proposed that WASWC organization members should be invited to co-publish the book in order to enhance its dissemination through bulk purchases by these organizations, thereby lowering the book's price. It became an unprecedented phenomenon: more than five dozen organizations embraced our offer and became co-publishers. At the same time a large proportion of them had offered to submit their papers, which made the book even more informative than before – something way beyond our anticipations. From a 5-paper book, our SP III had expanded to become a 544-page no-tillage compendium with 34 papers showcasing no-till experience from various territories of the world. Four additional editors (Michael Zoebisch, Yantai Gan, Wyn Ellis and Alex Watson) were invited to help to cope with the increased editing burden and very short deadlines.

For me personally, and for WASWC it is of course most gratifying to see such sustained commitment and willing cooperation to ensure the success of this publication. With initial sales through the co-publishing program already approaching 7,000 copies, we are certain our message will be well read worldwide by those interested in no-till farming systems, and we hope will also stimulate new ideas and initiatives to further refine and adapt the system to local conditions.

Our thanks and most sincere appreciation is extended to all who have offered helping hands to support this publication in various ways. Special thanks are due to the companies and individuals that have given their financial support, enabling us to produce this volume at an attractive price, accessible to a larger portion of the globe – thus fulfilling the global mandate of WASWC in managing and conserving the world's important natural resources – soil and water.

Samran Sombatpanit

Immediate Past President and Editor

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.Introduction*

Lester R. Brown

In 1938, Walter Lowdermilk, a senior official in the Soil Conservation Service of the U.S. Department of Agriculture, traveled abroad to look at lands that had been cultivated for thousands of years, seeking to learn how these older civilizations had coped with soil erosion.

He found that some had managed their land well, maintaining its fertility over long stretches of history, and were thriving. Others had failed to do so and left only remnants of their illustrious pasts.

In a section of his report entitled *"The Hundred Dead Cities,"* he described a site in northern Syria, near Aleppo, where ancient buildings were still standing in stark isolated relief, but they were on bare rock. During the seventh century, the thriving region had been invaded, initially by a Persian army and later by nomads out of the Arabian Desert. In the process, soil and water conservation practices used for centuries were abandoned. Lowdermilk noted, "Here erosion had done its worst. ... If the soils had remained, even though the cities were destroyed and the populations dispersed, the area might be re-peopled again and the cities rebuilt, but now that the soils are gone, all is gone."

Now fast forward to a trip in 2002 by a United Nations team to assess the food situation in Lesotho, a small country of 2 million people imbedded within South Africa. Their finding was straightforward: "Agriculture in Lesotho faces a catastrophic future; crop production is declining and could cease altogether over large tracts of the country if steps are not taken to reverse soil erosion, degradation, and the decline in soil fertility."

Michael Grunwald reports in the Washington Post that nearly half of the children under five in Lesotho are stunted physically. "Many," he says, "are too weak to walk to school."

Whether the land is in northern Syria, Lesotho, or elsewhere, the health of the people living on it cannot be separated from the health of the land itself. A large share of the world's 852 million hungry people live on land with soils worn thin by erosion.

The thin layer of topsoil that covers the planet's land surface is the foundation of civilization. This soil, measured in inches over much of the earth, was formed over long stretches of geological time as new soil formation exceeded the natural rate of erosion. As soil accumulated over the eons, it provided a medium in which plants could grow. In turn, plants protect the soil from erosion. Human activity is disrupting this relationship.

Sometime within the last century, soil erosion began to exceed new soil formation in large areas. Perhaps a third or more of all cropland is losing topsoil faster than new soil is forming, thereby reducing the land's inherent productivity. Today the foundation of civilization is crumbling. The seeds of collapse of some early civilizations, such as the Mayans, may have originated in soil erosion that undermined the food supply.

The accelerating soil erosion over the last century can be seen in the dust bowls that form as vegetation is destroyed and wind erosion soars out of control. Among those that stand out are the Dust Bowl in the U.S. Great Plains during the 1930s, the dust bowls in the Soviet Virgin Lands in the 1960s, the huge one that is forming today in northwest China, and the one taking shape in the Sahelian region of Africa.

Each of these is associated with a familiar pattern of overgrazing, deforestation, and agricultural expansion onto marginal land, followed by retrenchment as the soil begins to disappear.

Twentieth-century population growth pushed agriculture onto highly vulnerable land in many countries. The overplowing of the U.S. Great Plains during the late nineteenth and early twentieth centuries, for example, led to the 1930s Dust Bowl. This was a tragic era in U.S. history, one that forced hundreds of thousands of farm families to leave the Great Plains. Many migrated to California in search of a new life, a move immortalized in John Steinbeck's *"The Grapes of Wrath"*.

Three decades later, history repeated itself in the Soviet Union. The Virgin Lands Project between 1954 and 1960 centered on plowing an area of grassland for wheat that was larger than the wheatland in Canada and Australia combined. Initially this resulted in an impressive expansion in Soviet grain production, but the success was short-lived as a dust bowl developed there as well.

Dust storms originating in the new dust bowls are now faithfully recorded in satellite images. In early January 2005, the National Aeronautics and Space Administration (NASA) released images of a vast dust storm moving westward out of central Africa. This vast cloud of tan-colored dust stretched over some 5,300 kilometers (roughly 3,300 miles). NASA noted that if the storm were relocated to the United States, it would cover the country and extend into the oceans on both coasts.

Andrew Goudie, Professor of Geography at Oxford University, reports that Saharan dust storms—once rare—are now commonplace. He estimates they have increased 10-fold during the last half-century. Among the countries in the region most affected by topsoil loss from wind erosion are Niger, Chad, Mauritania, northern Nigeria, and Burkino Faso. In Mauritania, in Africa's far west, the number of dust storms jumped from 2 a year in the early 1960s to 80 a year today. The Bodélé Depression in Chad is the source of an estimated 1.3 billion tons of wind-borne soil a year, up 10-fold from 1947 when measurements began. The 2 to 3 billion tons of fine soil particles that leave Africa each year in dust storms are slowly draining the continent of its fertility and, hence, its biological productivity. In addition, dust storms leaving Africa travel westward across the Atlantic, depositing so much dust in the Caribbean that they cloud the water and damage coral reefs there.

In China, plowing excesses became common in several provinces as agriculture pushed northward and westward into the pastoral zone between 1987 and 1996. In Inner Mongolia (Nei Mongol), for example, the cultivated area increased by 1.1 million hectares, or 22 percent, during this period. Other provinces that expanded their cultivated area by 3 percent or more during this nine-year span include Heilongjiang, Hunan, Tibet (Xizang), Qinghai, and Xinjiang.

Severe wind erosion of soil on this newly plowed land made it clear that its only sustainable use was controlled grazing. As a result, Chinese agriculture is now engaged in a strategic withdrawal in these provinces, pulling back to land that can sustain crop production.

Water erosion also takes a toll on soils. This can be seen in the silting of reservoirs and in muddy, silt-laden rivers flowing into the sea. Pakistan's two large reservoirs, Mangla and Tarbela, which store Indus River water for the country's vast irrigation network, are losing roughly 1 percent of their storage capacity each year as they fill with silt from deforested watersheds.

Ethiopia, a mountainous country with highly erodible soils on steeply sloping land, is losing an estimated 1 billion tons of topsoil a year, washed away by rain. This is one reason Ethiopia always seems to be on the verge of famine, never able to accumulate enough grain reserves to provide a meaningful measure of food security.

Fortunately there are ways to conserve and rebuild soils. In reviewing the literature on soil erosion, references to the "loss of protective vegetation" occur again and again. Over the last half-century, we have removed so much of that protective cover by clearcutting, overgrazing, and overplowing that we are fast losing soil accumulated over long stretches of geological time. Eliminating these excesses and the resultant decline in the earth's biological productivity depends on a worldwide effort to restore the earth's vegetative cover.

The secret of avoiding soil erosion is to never allow the soil to be bare and unprotected, but to ensure that the soil surface is always covered with growing plants or the dead mulch from these same plants. To achieve this in modern agriculture, all types of tillage and soil loosening should be avoided. The no-tillage technology described in detail later in this book has shown to be one of the most efficient methods of protecting the soil from being eroded by wind and water. This system is very similar to a permanent pasture. In addition to reducing erosion, this practice helps retain water, raises soil carbon content, and reduces the energy needed for crop cultivation. Instead of plowing land, disking or harrowing it to prepare the seedbed, and then using a mechanical cultivator to control weeds, farmers simply drill seeds directly through crop residues into undisturbed soil (with special machines), controlling weeds with herbicides. The only soil disturbance is the narrow slit in the soil surface where the seeds are inserted, leaving the remainder of the soil undisturbed, covered by crop residues and thus resistant to both water and wind erosion. Small farmers can no-till seed their crops using a stick or a manual hand planter.

Now widely used in the production of corn and soybeans in the United States, no-till has spread rapidly in the Western Hemisphere, covering 25 million hectares in the U.S.A., 24 million hectares in Brazil, 18 million hectares in Argentina, and 13 million hectares in Canada. Australia, with 9 million hectares, rounds out the five leading no-till countries. Worldwide, the no-tillage technology was applied on 45 million hectares in 1999 and has expanded to about 95 million hectares in 2005. It now exceeds the 100 million hectares mark. Farmers worldwide are increasingly recognizing the environmental benefits of this technology: No-till protects the soil from wind and water erosion, reduces fossil fuel consumption, reduces CO_2 emissions while also providing CO_2 sequestration, and increases soil fertility and productivity. Overall, it helps reduce farm expenses and increase the quality of life for farmers.

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*Adapted largely from Chapter 5, "Natural Systems Under Stress," in Lester R. Brown, Plan B 2.0: Rescuing a Planet Under Stress and a Civilization in Trouble (New York: W.W. Norton & Company, 2006), available for free downloading and purchase at www.earthpolicy.org/Books/PB2/index.htm.

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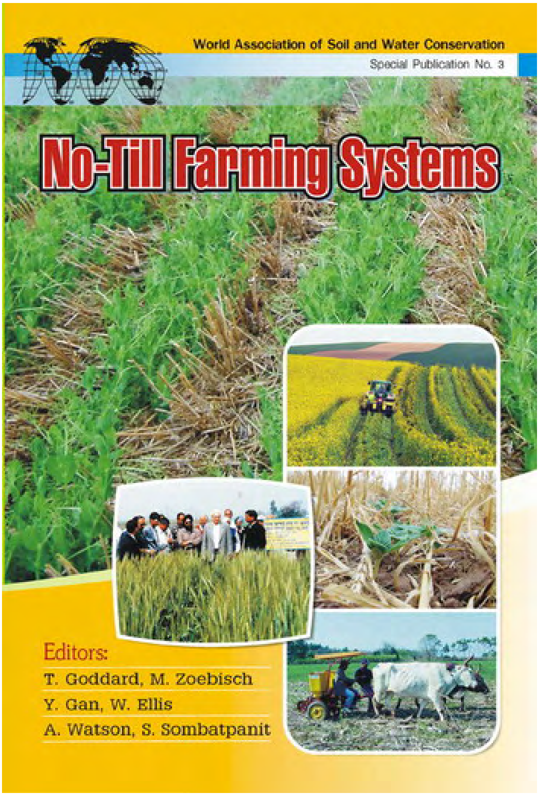

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WASWC:
Its History, Operations and Publications

By

Bill Moldenhauer and David Sanders (2003)
Updated by Samran Sombatpanit (2007)

WASWC was established in 1983 with the help and support of the Soil and Water Conservation Society (SWCS) of the U.S.A. The original purpose was to support international activities of both SWCS and the International Soil Conservation Organization (ISCO). The world was divided into nine regions with at least one Vice President from each region. Since there was little contact among ISCO participants from one biennial conference to the next, our first priority was to publish a quarterly newsletter with meeting announcements, international conservation news, book reviews, member news, etc. From the beginning, we tried to give recognition to, and a forum for, workers in the international field who had published mainly in the "gray literature" (company, Government (GO) and non-governmental (NGO) agency and organization reports that had had very small circulation).

This continues to be one of our most vital functions. By 1986 there was great interest in the Food and Agriculture Organization (FAO) of the United Nations and many GOs and NGOs in just how effective their international programs were in solving problems in developing countries. WASWC and SWCS organized a workshop in Puerto Rico with the help of several donor organizations and invited speakers to address the success (or failure) of donor sponsored soil and water conservation and land husbandry programs in developing countries worldwide.

This was a very successful conference and resulted in two publications published by SWCS, *Conservation Farming on Steep Lands* and *Land Husbandry: A Framework for Soil and Water Conservation.* Since our Puerto Rico workshop we have held a workshop in Taiwan in 1989, one in Solo, Central Java, Indonesia, in 1991, and one in Tanzania and Kenya in 1993. These have all been published and were circulated by SWCS.

Our Vice President for Europe, Dr. Martin Haigh, has initiated a series of meetings on Environmental Regeneration in Headwaters in various parts of the globe. Our Vice President for the Pacific Region, Dr. Samir El-Swaify, has initiated a series on "Multiple Objective Decision Making for Land, Water and Environmental Management." Four of our members—Samran Sombatpanit, Michael Zoebisch, David W. Sanders, and Maurice Cook have edited a book titled, *Soil Conservation Extension: From Concepts to Adoption.* David Sanders, Paul Huszar, Samran Sombatpanit and Thomas Enters have edited a book titled, *Incen-*

tives in Soil Conservation: From Theory to Practice. Lately, Samran Sombatpanit has edited a voluminous book, *Response to Land Degradation,* with five other editors in 2001 and *Ground and Water Bioengineering for Erosion Control and Slope Stabilization*, with four other editors in 2004. Besides the above publications, past WASWC President Hans Hurni initiated a long-term program, "World Overview of Conservation Approaches and Technologies (WOCAT)," based in Berne, Switzerland in 1992 and had a landmark WOCAT Global Overview book *"where the land is greener"* published in 2006. WASWC has supported Jim Cheatle's "Organic Matter Management Network" based in Nairobi, Kenya. WASWC is also closely allied with Reseau Erosion, a project of Vice President Eric Roose, based in Montpellier, France, and operating mainly in Africa. WASWC is closely allied to ISCO and cooperates fully with planning and conducting its biennial conferences. WASWC is requested and very willing to co-sponsor conferences, symposia and workshops it feels will further its philosophy and objectives.

The WASWC Philosophy: WASWC philosophy is that the conservation and enhancement of the quality of soil and water are a common concern of all humanity. We strive to promote policies, approaches and technologies that will improve the care of soil and water resources and eliminate unsustainable land use practices.

WASWC Vision: A world in which all soil and water resources are used in a productive, sustainable and ecologically sound manner.

WASWC Mission: To promote worldwide the application of wise soil and water management practices that will improve and safeguard the quality of land and water resources so that they continue to meet the needs of agriculture, society and nature.

WASWC Slogan: Conserving soil and water worldwide – join WASWC

The Objectives of WASWC: The basic objective of WASWC is to promote the wise use of our soil and water resources. In doing so WASWC aims to:

• Facilitate interaction, cooperation and links among its members.

• Provide a forum for the discussion and dissemination of good soil and water conservation practices.

• Convene and hold conferences and meetings and conduct field studies connected with the development of better soil and water conservation.

• Assist in developing the objectives and themes for ISCO conferences and collaborate in their running.

• Produce, publish and distribute policies, guidelines, books, papers and other information that promote better soil and water conservation.

• Encourage and develop awareness, discussion and consideration of good conservation practices among associated organizations.

• Liaise, consult and work in conjunction with environmental organizations on the development and promulgation of global environmental and conservation policies, strategies and standards.

Recent Developments: The WASWC has had to face some serious problems in recent years and, as a result, some important changes have taken place. The cost of running WASWC has increased over the years and, at the same time, membership numbers dropped to below 400. The drop in numbers was partly because a membership fee of even US$10 per year is a considerable amount of money for many members from developing countries. Added to this, is the problem of paying in dollars and transferring relatively small sums of money internationally. To overcome these problems, a number of important steps have been taken. *First,* a concerted effort has been made to recruit new members. As part of this campaign, an effort has been made to improve the services provided to members. This has included improving the quality and length of the quarterly newsletter and distributing it by e-mail. *Second*, a flexible system of membership fees has been introduced which means that members can join for as little as US$5 and US$10 per year for respectively developing and developed countries. *Third,* a program of decentralization has also been launched with the appointment of several more Vice Presidents and the establishment of National Representatives, now covering approximately 100 countries. This program is not only bringing our association closer to members but has also provided other advantages including a system whereby it is now possible for local organizations to collect membership fees in local currencies and to pay the secretariat in bulk. *Fourth,* the WASWC council has become more actively involved in encouraging regional and local meetings, conferences and other useful activities. *Fifth,* the WASWC council offers 1-year Guest membership to persons who have participated at any technical meeting worldwide, if they wish so. As a result of these measures, membership has risen to several thousands in 2007.

Another major change has been the move of the WASWC secretariat from the SWCS in the U.S.A. to Beijing in China, on April 1, 2003. It is now hosted by the Ministry of Water Resources. The WASWC appreciates the generous help that it received from the SWCS over the 20 years that the SWCS ran its secretariat and intends to maintain a close association with it in the future. However, the Council believes that this move will have a number of advantages. Our Chinese hosts have offered very generous terms for the running of the secretariat; we will have the opportunity to work in a country where running costs are relatively low and where there is considerable technical expertise available and of interest to many of our members. The most recent development is the establishment of our main website at the Guangdong Institute of Eco-Environmental and Soil Sciences in Guangzhou, in the southern part of China, to offer services to our members along with the other one in Tokyo, Japan, supported by ERECON.

WASWC Council

(For the period up to December 2007)

President: Miodrag Zlatic, Serbia
Deputy President: Machito Mihara, Japan
Treasurer: John Laflen, U.S.A.
Executive Secretary: Jiao Juren, China
Imm. Past President: Samran Sombatpanit, Thailand (& Membership Coordinator)
Councilor for Africa: Mohamed Sabir, Morocco
Councilor for America (Latin): Eduardo Rienzi, Argentina
Councilor for America (North): Ted Napier, U.S.A.
Councilor for Australasia: Ian Hannam, Australia
The next council will operate from January 2008 for a period of 3 years.
Contact Samran Sombatpanit (sombatpanit@yahoo.com) for further information.

Past Presidents

1983-1985: William C. Moldenhauer, U.S.A.
1986-1988: Norman W. Hudson, UK
1989-1991: Rattan Lal, U.S.A.
1992-1997: Hans Hurni, Switzerland
1997-2001: David W. Sanders, UK
2002-2004: Samran Sombatpanit, Thailand
January-March 2005: Martin Haigh, UK
April 2005-June 2006: Samran Sombatpanit, Thailand (Acting)

WASWC Secretariat and Websites: See p. viii, this volume

WASWC Publications

– Published in association with other institutions or publishers –

1988

• *Conservation Farming on Steep Lands.* Edited by W.C. Moldenhauer and N.W. Hudson, ISBN 0935734198

1989

• *Land Husbandry – A Framework for Soil and Water Conservation.* by T.F. Shaxson, N.W. Hudson, D.W. Sanders, E. Roose and W.C. Moldenhauer, ISBN 0935734201

1990

• *Soil Erosion on Agricultural Land.* Edited by J. Boardman, I.D.L. Foster and J.A. Dearing, ISBN 0471906027 (From a meeting co-sponsored by WASWC)

1991

• *Development of Conservation Farming on Hillslopes.* Edited by W.C. Moldenhauer, N.W. Hudson, T.C. Sheng and San-Wei Lee, ISBN 0935734244

• *Soil Management for Sustainability.* Edited by R. Lal and F.J. Pierce, ISBN 0935734236

1992

• *Conservation Policies for Sustainable Hillslope Farming.* Edited by S. Arsyad, I. Amien, Ted Sheng and W.C. Moldenhauer, ISBN 0935734287

• *Soil Conservation for Survival.* Edited by K. Tato and H. Hurni, ISBN 0935734279

• *Erosion, Conservation and Small-Scale Farming.* Edited by H. Hurni and K. Tato, ISBN 3906290700

• Environmental Regeneration in Headwaters. Edited by J. Krecek and M.J. Haigh

1993

• *Working with Farmers for Better Land Husbandry.* Edited by N. Hudson and R.J. Cheatle, ISBN 1853391220

1995

• *Adopting Conservation on the Farm: An International Perspective on the Socio-economics of SWC.* Edited by T.L. Napier, S.M. Camboni and S.A. El-Swaify, ISBN 0935734317

1996

• *Hydrological Problems and Environmental Management in Highlands and Headwaters.* Edited by J. Krecek, G.S. Rajwar and M.J. Haigh, ISBN 8120410483

1997

• *Soil Conservation Extension: From Concepts to Adoption.* Edited by S. Sombatpanit, M. Zoebisch, D. Sanders and M.G. Cook, ISBN 8120411897

1999

• *Multiple Objective Decision Making for Land, Water and Environmental Management.* Edited by S.A. El-Swaify and D.S. Yakowitz, ISBN 1-57444-091-8

• *Incentives in Soil Conservation: From Theory to Practice.* Edited by D.W. Sanders, P. Huszar, S. Sombatpanit and T. Enters, ISBN 1-57808-061-4

2000

• *Reclaimed Land: Erosion Control, Soils and Ecology.* Edited by M.J. Haigh, ISBN 90 5410 793 6

2001

• *Response to Land Degradation.* Edited by E.M. Bridges, I.D. Hannam, L.R. Oldeman, F. Penning de Vries, S.J. Scherr and S. Sombatpanit, ISBN 812041942

2004

• *Ground and Water Bioengineering for Erosion Control and Slope Stabilization.* Edited by D.H. Barker, A.J. Watson, S. Sombatpanit, B. Northcutt and A.R. Maglinao, ISBN 1-57808-209-9

2007

• *Monitoring and Evaluation of Soil Conservation and Watershed Development Projects.* Edited by J. de Graaff, J. Cameron, S. Sombatpanit, C. Pieri and J. Woodhill. ISBN 978-1-57808-349-7

Special Publications, published by WASWC

2003: No. 1. *Pioneering Soil Erosion Prediction – The USLE Story.* By John Laflen and Bill Moldenhauer, ISBN 974 91310 3 7, 54 pp. (available on the website)

2004: No. 2. *Carbon Trading, Agriculture and Poverty.* By Mike Robbins, ISBN 974 92226 7 9, 48 pp. (available on the website)

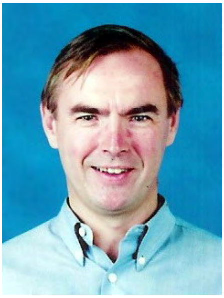
2008: No. 3. *No-Till Farming Systems.* Edited by Tom Goddard, Michael A. Zoebisch, Yantai Gan, Wyn Ellis, Alex Watson and Samran Sombatpanit, ISBN 978-974-8391-60-1, 544 pp.

The Editors

Mr. Tom Goddard has worked with no-till development over the last three decades from research plot scale to farm-field scales while working as a summer student, an agricultural extension agent and a soils specialist. His varied experience ranges across agricultural extension, environmental consulting and applied research. Research activities have covered precision farming applications, site-specific management, landscape science, soil quality monitoring, erosion processes and greenhouse gas emissions. He is currently on a secondment to the policy secretariat from his position as head of soils and climate change section for Alberta Agriculture and Food. He resides in Edmonton, Canada with Elizabeth and their three teenaged children.

Dr. Michael Zoebisch is a soil and water engineer and agronomist with more than 25 years of experience in Asia, Africa and the Middle East. He specializes in land and water management and the conservation of natural resources. Michael is chartered engineer and chartered environmentalist. He has worked for the International Center for Agricultural Research in the Dry Lands (ICARDA) and as Visiting Professor at the universities of Kumasi (Ghana), Nairobi (Kenya) and for the Asian Institute of Technology - AIT in Thailand. Michael has initiated and managed substantial research projects in Kenya, Syria and Thailand. He is currently senior advisor for the university reform program in Ethiopia responsible for curriculum development

Dr. Yantai Gan, a Research Scientist with Agriculture and Agri-Food Canada, the Canadian Federal Department of Agriculture, has been focusing his research on the development of diverse no-till cropping systems in the past 15 years. His research achievement is reflected in some 80 papers published in refereed journals and over 200 technical articles. Currently, Dr. Gan is the Director of North America Pulse Improvement Association and the Director of Canadian Society of Agronomy. He is active in training graduates, being Adjunct Professor at four universities: the University of Saskatchewan in Canada; China Agricultural University in Beijing; Lanzhou University in Lanzhou, China; and Gansu Agricultural University in Gansu, China. He is also serving Associate Editor for Canadian Journal of Plant Science.



Mr. Wyn Ellis is a Senior Adviser with the GTZ Thai-German Programme for Enterprise Competitiveness, based in Bangkok. With 29 years of consultancy experience covering crop protection, biosafety, organic farming, innovation management, and sustainable development, he has advised on major rural development programs in Africa and Asia, and has lived in Asia for the past 22 years. He holds degrees from the Universities of Oxford and Reading in UK.

Mr. Alex Watson has worked as a researcher in New Zealand for the past 25 years. He has over that time been engaged in investigations involving catchment hydrology and associated land use change issues, plantation and forest water use, tree and tree root anchorage and their relationships to slope and wind stability, and erosion process studies. His previous editorial responsibilities have included co-editing *Ground and Water Bioengineering for Erosion Control and Slope Stabilisation* in 2004. He is currently employed by Landcare Research New Zealand Ltd.

Dr. Samran Sombatpanit had worked as a land development officer of the Land Development Department, Thailand, during the period 1964-1999, the last 18 years having spent for soil and water conservation. He established the Soil and Water Conservation Forum of Thailand in 1980 and served as a Vice President of WASWC for Asia in 1995, Deputy President for 1997-2001, President for 2002-2004, Acting President for January 2005 to mid-2006 and Past President for mid-2006 to December 2007. He has edited the book *Soil Conservation Extension* in 1997 and co-edited *Incentives in Soil Conservation* in 1999, *Response to Land Degradation* in 2001, *Ground and Water Bioengineering for Erosion Control and Slope Stabilization* in 2004 and *Monitoring and Evaluation of Soil Conservation and Watershed Development Projects* in 2007.

Words of Appreciation

WASWC sincerely appreciates cooperation from the following businesses and individuals for giving financial help from the start of the project, to enable its implementation and to make the book available to worldwide readers at an affordable price.

Syngenta AG, Basel, Switzerland
www.syngenta.com/en/index.aspx

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Eijkelkamp Agrisearch Equipment, Giesbeek, The Netherlands www.eijkelkamp.com

SonTek Company, San Diego, U.S.A.
www.sontek.com

Donald Fryrear Custom Products and Consultants, Big Spring TX, U.S.A.
www.csrl.ars.usda.gov/wewc/bfryrear.htm

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(Left) *Wind erosion and* (right) *Bill Fryrear with a special chrome-plated BSNE Sampler, which he invented, given to him at his retirement from USDA-ARS*

Contact Donald W. (Bill) Fryrear at
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Additional information: www.fryreardustsamplers.com/index.html
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The aggregate stability of a soil is the resistance of soil structure against mechanical or physico-chemical destructive forces. Soil structure is one of the main factors controlling plant growth by its influence on root penetration, soil temperature and gas diffusion, water transport and seedling emergence and therefore it is an important soil characteristic for farmers. The wet sieving apparatus is used to determine the above mentioned aggregate stability. The wet aggregate stability is determined on the principle that unstable aggregates will break down more easily than stable aggregates when immerged into water. The testing procedure results in an index for aggregate stability.

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Syngenta is committed to supporting the concepts of conservation agriculture and works with partners and stakeholders worldwide on many projects to enhance soil and water quality.